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A Factorial Analysis of Athletic Ability[1]

GEORGE HIGHMORE
Loughborough Training College
Leicestershire, England

Abstract

This article describes a comparative study between the Thurstone and Holzinger factorial techniques which samples a population that is likely to remain unique. It comprised 240 war veterans, whose average age was 30 years, attending an English Emergency Training College for Teachers. So large an adult population had not been tested previously in England in order to analyze statistically their athletic prowess. The analysis, based on nine athletic tests drawn from a preliminary battery of 14 items, revealed clearly a general factor together with three group factors. The practical application of regression equations using three of the tests is illustrated.

THIS STUDY WAS carried out with 240 men, almost exclusively war veterans, attending an English Emergency Training College for Teachers.[2] The average age was 30 years and so large a population of adults, as distinct from adolescents and persons of normal college age, had not been tested previously in England for the purpose of analyzing statistically their athletic prowess.

Aim of the Research

It was realized from a pilot investigation[3] that an analysis of the psychophysical features of general athletic ability was a formidable undertaking. The research, therefore, was limited to a study of the physical nature of athletic ability. It was decided that the testing should cover total behavior, because previous experience had shown that the best results were obtained when the individual responded as a whole. The tests were also to be situational in that they should conform to the actual physical movements employed in athletics as against "stunts." It was, further, considered profitable to omit the competitive element and to avoid tests requiring a response to ball play.

The selection of the tests, therefore, was as wide as the aim of the research allowed. By comparison with other attempts to measure in this field, the battery, although its separate items have their distinct characteristics, may appear limited. Cureton, for example, used 28 items for his test of muscular endurance (5), 14 and 18 items for his Illinois Motor Fitness batteries (6)

[1]Based on a section of the authors unpublished doctoral dissertation, *A Factorial Analysis of Athletic Ability Preparatory to the Formulation of a Series of Prognostic Tests*, University of London, 1949.

[2]Burderop Park Training College, Wroughton, Near Swindon, Wiltshire, England.

[3]Reported in Chapters I and II of the dissertation mentioned in footnote 1.

and for his all-round Physical Fitness rating 34 Motor Fitness items appear beside 4 Organic and 13 Physique scores (6, *p. 496*). He employs these comprehensive lists in order to cover what he claims to be the six fundamental aspects of Motor Fitness; namely, balance, flexibility, agility, strength, power, and endurance. The tests used in the present research sample athletic ability instead of attempting to embrace it completely.

Administration of the Tests

The work of administration took one month and was carried out on the college campus.[4] Each student understood that he was a voluntary helper, and the purpose of the testing was explained to him.

CRITERION

A criterion was established in the form of a five-point rating scale supplied by two physical education experts[5] who had known the men for over a year. The raters were asked to judge performance rather than motivation. For example, grace of athletic performance was to outweigh any consideration of enthusiasm.

TESTERS' PERSONAL DATA

Age—Figures were extracted from the men's personal dockets.

Height—A scale was drawn on the wall of the gymnasium. The men were measured in stocking feet.

Weight—The men wore socks, shorts, and gym shirts and the weighing was carried out on a standard machine in the gymnasium.

DESCRIPTION OF THE TESTS

Fifty-Yard Sprint. The sprint was made on a level run of concrete, the men wearing plimsolls and the usual physical education dress. The starter indicated that the man had begun to run by dropping the hand and an assistant at the finish manipulated a stopwatch accordingly. The runner began from the attention position at the starting line. One sprint only, which was recorded in seconds and fifths, was made.

Quarter-Mile Run. The course was so designed that the runner began and finished at the same spot. This necessitated a course, laid out on concrete, which included three gentle turns. The starter also recorded the finish by stopwatch. Normal physical education dress was worn by the runners. One run only, recorded in seconds and fifths, was made.

Medicine Ball Put. This took place in the gymnasium. The subjects were changed into normal physical education dress. The feet of the testee were together and the knees straight. The arms had to be pushed straight out, and the student was warned to keep the hands by the side of the seven-pound ball to avoid the extra flick which could be obtained by placing them behind it. The put had to be made upwards and outwards at an angle of 45°, and the spot on which the ball dropped indicated the distance to be measured, in inches, from the starting line, and this was recorded as the score. The best of

[4]March-April, 1948.

[5]R. Probert, B.Sc., Dip. Carnegie and D. J. Vandyke, Pip. Carnegie.

three attempts was taken. A suitable scale of measurement, previously drawn on the floor of the gymnasium, helped the recording which was carried out by two assistants.

Throwing the Cricket Ball. Two assistants supervised the two throws made and the better distance, recorded in feet, was taken as the score. A standard-weight leather ball was used. A run up, on concrete, to the throwing line was allowed. Plimsolls were worn but, apart from the removal of jackets, the men did not change. No throws were made when the concrete was wet. The subjects were instructed to throw upwards at an angle of 45° and misfires were ignored.

Soccer Ball Punt. The subject wore ordinary shoes or boots. The ball was placed on grass for the kick and the run-up was also on grass. The ball was static when kicked. The man had to kick up at an angle of 45°. Miskicks were retaken. The score was reckoned in feet from the kicking spot to the point where the ball landed. The better of two attempts was taken as the score. A No. 5 soccer ball was used. Two assistants conducted the test.

Standing Upward Jump. This was taken in the anteroom to the gymnasium. The subject wore shorts, plimsolls and a bathing cap. A vertical centimeter scale was calibrated on a light buff-colored wall. At a distance of six feet from this wall, an electric light was placed in front of a mirror so that the wall was brightly illuminated. The subject toed a line one foot from the wall, facing it so that the light was behind him and his shadow clearly outlined. The bathing cap helped to make a sharp shadow. The assistant read off the subject's height in centimeters from the shadow. The man was in the attention position.

The subject then jumped on the spot. He was allowed to flex the knees in preparation but the hands had to be kept by the sides during the jump. The assistant recorded the highest point reached by the shadow and the difference between the standing height and the height reached in the jump was the student's score. The best of three attempts was accepted.

Running Broad Jump. A sand-pit measuring 12 by 6 feet was used. It was filled to a depth of one foot and the perimeter suitably edged with concrete blocks. The approach lane measuring 20 yards long by two feet wide was laid in cinders. Wearing physical education dress, the student made three jumps and the best was taken as his score in inches. The take-off took the form of a board nine inches wide placed with its near edge five feet from the pit. This board was lightly sanded and the man's distance was reckoned from the toe mark on the board to the heel mark of the rear foot in the pit. False jumps were retaken and the student told to concentrate on the jump, not on the take-off. He was instructed to jump high. Two assistants controlled the test.

High Jump. This was taken in the gymnasium on mats. A rope was used with the jumping stands. The student was allowed to use his best jumping style and approach. He wore plimsolls as part of his normal physical education dress. Two assistants carried out the test. Scores were recorded in half

TABLE 1

The Correlation Matrix

Units	Points	Sec.	Sec.	In.	Feet	Feet	Cm.	In.	In.	In.
Mean	8.00	6.95	76.11	195.50	154.16	106.20	45.58	170.25	95.83	84.02
S.D.	0.07	.46	6.18	23.85	33.00	22.61	6.13	18.60	7.72	8.69
	Criterion	Fifty Yards	Quart. Mile	Med. Ball Put	Cricket Ball	Soccer Punt	Stand. Up. Jump	Run. Broad Jump	High Jump	Stand. Broad Jump
Fifty Yards	.340		.497	.189	.288	.320	.255	.415	.392	.240
Quarter Mile	.386			.214	.335	.196	.179	.450	.464	.344
Medicine Ball Put	.371				.352	.261	.262	.230	.313	.370
Cricket Ball	.498					.349	.247	.404	.403	.430
Soccer Ball Put	.418						.150	.307	.279	.228
Standing Upward Jump	.215							.357	.421	.492
Running Broad Jump	.468								.591	.538
High Jump	.399									.522
Standing Broad Jump	.446									

inches and arrived at by accepting the highest jump made. Three failures at the next highest jump decided the score.

Standing Broad Jump. This was carried out in the gymnasium. The man stood with feet together on a chalked line and jumped upwards and forwards onto mats. Alongside the mats a scale in inches had been drawn. His score, recorded in inches, was the distance from his toes at the starting point to the heels when the jump was taken. The best of three attempts was accepted. One assistant managed the test.

Intelligence Quotients. The figures had been obtained when the students entered the college about a year previously. The test used was the National Institute of Industrial Psychology's Group Test No. 33.

Wing Rhythm Test (17). This was extracted from a battery of tests used for the measurement of musical ability and the results assess an individual's capacity to discriminate musical rhythm by listening to special gramophone records.

Statistical Treatment

All the results were reduced to standard (Z) scores and intercorrelated using the Bravais-Pearson method. For a population of the size sampled, it was noted that the level of significance for a coefficient was .2 assuming that the coefficient should exceed four times its P.E. Sample partial correlation coefficients further indicated that some tests could be eliminated. It was found that age, height, and weight played a negligible part in the problem; and it was seen that intelligence does not correlate with athletic ability. Further, according to the Wing scores, a sense of musical rhythm does not correlate with athletic rhythm.

The reduced correlation matrix shown in Table 1 covered, therefore, the nine athletic tests.

FACTOR ANALYSES

Thurstone. Burt's (4) Simple Summation technique was used as a trial method preliminary to a Thurstone "Centroid" analysis (13). Two criteria for cessation of factor extraction were used, namely, Ledyard Tucker's (14) and Reyburn and Taylor's (11); and the unrotated factor loadings, which are shown in Table 2, were rotated in three ways. Thurstone's *Two by Two* and Alexander's (2) methods gave orthogonal factors and Thurstone's Extended Vector technique yielded oblique factors. The results are shown in Table 3. An attempt at *Second Order* factorization following the Thurstone approach proved mathematically impossible.

Holzinger. Thurstone's Multiple Group Factor method was used as an introductory link between his *Centroid* procedure and Holzinger's (10) Bi-factor technique, which gave the general and group factors shown in Table 4.

ASSESSMENT OF THE FACTOR ANALYSIS

Both the Thurstone and Holzinger approaches indicate a general factor of athletic ability but, because of the nature of the statistical technique, this is

TABLE 2

Thurstone Factors (Unrotated)

Criterion	First Factor	Second Factor	Third Factor
Fifty Yards	.575	.416	.021
Quarter Mile	.591	.289	—.106
Medicine Ball Put	.476	—.227	.262
Cricket Ball	.602	—.042	.201
Soccer Ball Punt	.454	.093	.334
Standing Upward Jump	.531	—.291	—.133
Running Broad Jump	.722	.104	—.243
High Jump	.739	—.014	—.206
Standing Broad Jump	.688	—.340	—.190

more clearly marked in the Holzinger results. At the risk of reifying statistical entities, the Holzinger first, second, and third factors might be identified as elements connected with running, throwing, and jumping respectively. Unlike investigations in the psychological field where it is hazardous to name factors as representing, say, memory, reasoning, or space perception, work in athletics is concerned with performances that can easily be observed. An athlete's success or failure is as easy to note as a person's proficiency on a musical instrument.

The Thurstone and Alexander rotations fail to achieve their aim of identifying independent primary factors, and the general factor persistently emerges. Thurstone's *oblique factors* obtained by the Extended Vector technique neither show a general factor nor suggest a common-sense interpretation.

It can be noticed, however, that the "specific" variances in the Thurstone and the Holzinger results compare favorably (Table 5), which suggests that the divergence between the two is not alarmingly great and that they are disagreeing within the common factor space only. There need be no dismay because more of the common factor space is not covered, because the "specific" variance does not necessarily imply waste but probably indicates not only sampling errors but the knack of performing the test.

REGRESSION EQUATIONS

The factorial results suggested that three tests should be included in any regression equation; and, by inspection of the factor matrices, a comparison of the correlations of the tests with the criterion (as shown in Table 1) and a consideration of the ease of administration, the Fifty-Yard Sprint, the Medicine Ball Put, and the Standing Broad Jump were chosen. To arrive at the equations Aitken's (1) method of pivotal condensation was checked by a technique making a similar use of the calculation of tetrads based on a pivot described by Thomson (12). The estimation of a man's performance both in terms of all-round athletic ability and of the factors extracted is summarized in Table 6.

TABLE 3

Thurstone Factors (Rotated)

Criterion	First Factor			Second Factor			Third Factor		
	Two by Two	Alex-ander	Extended Vector	Two by Two	Alex-ander	Extended Vector	Two by Two	Alex-ander	Extended Vector
Fifty Yards	.313	.316	.458	.603	.610	.504	.206	.179	.000
Quarter Mile	.417	.415	.548	.512	.519	.336	.089	.055	—.005
Medicine Ball Put	.427	.449	—.011	—.008	.038	.356	.407	.381	.639
Cricket Ball	.476	.493	.177	.175	.286	.454	.380	.281	.513
Soccer Ball Punt	.253	.274	.005	.221	.233	.566	.458	.445	.450
Standing Upward Jump	.617	.620	.364	—.035	—.028	—.001	.043	.000	.378
Running Broad Jump	.648	.643	.699	.413	.418	.188	.006	.055	.085
High Jump	.701	.698	.640	.308	.318	.171	.043	.000	.214
Standing Broad Jump	.789	.790	.499	—.012	.000	.001	.042	.000	.446

Throwing the Cricket Ball proved itself to be the best single test of all-round athletic ability. It recorded the highest correlation with the criterion (.498) and its factorial readings were well balanced to give:

Thurstone, Two by Two ..... .476 First + .175 Second + .380 Third
Thurstone, Extended Vector ..... .177 First + .454 Second + .513 Third
Alexander ..... .493 First + .286 Second + .281 Third
Holzinger ..... .581 General + .363 Second group

APPLICATION OF THE REGRESSION EQUATIONS

To exemplify the use of one of the regression equations, the procedure can be described for estimating a man's all-round athletic ability.[6]

TABLE 4

Holzinger Factors

Criterion	General Factor	Group Factors		
		First	Second	Third
Fifty Yards	.514	.385		
Quarter Mile	.520	.385		
Medicine Ball Put	.416		.298	
Cricket Ball	.581		.363	
Soccer Ball Punt	.427		.270	
Standing Upward Jump	.430			.422
Running Broad Jump	.727			.179
High Jump	.743			.230
Standing Broad Jump	.624			.444

Percentage Variance

General Factor = 32.02
Group Factors = 11.67
Total = 43.69
Specific = 56.31

TABLE 5

Specific Variances

Criterion	Thurstone	Holzinger
Fifty Yards	.496	.588
Quarter Mile	.556	.582
Medicine Ball Put	.652	.738
Cricket Ball	.596	.530
Soccer Ball Punt	.673	.743
Standing Upward Jump	.615	.637
Running Broad Jump	.409	.439
High Jump	.412	.395
Standing Broad Jump	.376	.414

[6]The procedure was used at Loughborough Training College (1952) with 57 male students whose average age was 24 years (7). Correlations between the Test Results and Tutors' Assessments for Gymnastics, Tutors' Assessments for Athletics and Fellow Students' Ratings for Athletic Ability gave coefficients of .34 (S.E. .12), .53 (S.E. .09) and .49 (S.E. .10) respectively.

TABLE 6

Regression Equations

		Fifty Yards Sprint	Medicine Ball Put	Standing Broad Jump
All-round Athletic Ability		.225	.212	.314
FACTORS	Thurstone 2 × 2			
	First	.116	.142	.709
	Second	.652	−.079	−.139
	Third	.161	.434	−.159
	Alexander			
	First	.116	.167	.701
	Second	.650	−.031	−.144
	Third	.144	.425	−.192
	Holzinger			
	General	.368	.171	.473
	Group First	.413	−.048	−.082
	Group Second	−.037	.350	−.121
	Group Third	−.094	−.180	.534

In the first instance, this can be achieved by computing standard (Z) scores. The subject's time for the Fifty-Yard Sprint is recorded in seconds and fifths, his Medicine Ball Put in inches, and his Standing Broad Jump in inches. The deviation of these scores from their respective means (x) is taken and divided by the standard deviation ($S.D.$) of the tests to give the Z scores. These Z scores are inserted in the regression equation, and the result is the estimate in standard score form.

The available standards of achievement are those derived from the sample tested, namely:

	Means	*S.D.*
Fifty-Yard Sprint	6.95 sec.	.46 sec.
Medicine Ball Put	195.50 in.	23.85 in.
Standing Broad Jump	84.02 in.	8.69 in.

Moreover, since the regression coefficients and the S.D.'s are constant, the equation can be modified to expedite computation, thus:

$$x = .225\,\frac{(x \text{ Fifty Yards})}{(S.D. \quad " \quad)} + .212\,\frac{(x \text{ Med. Ball})}{(S.D. \quad " \quad)} + .314\,\frac{(x \text{ St. Br. Jump})}{(S.D. \quad " \quad)}$$

$$= \frac{.225}{.46}(x \text{ Fifty Yards}) + \frac{.212}{23.85}(x \text{ Med. Ball}) + \frac{.314}{8.69}(x \text{ St. Br. Jump})$$

$$= .489\,(x \text{ Fifty Yards}) + .009\,(x \text{ Med. Ball}) + .036\,(x \text{ St. Br. Jump})$$

If, secondly, the original or raw scores and not the deviations from the

means are used the appropriate equation is:

$$-.489\ (x \text{ Raw Fifty Yards}) + .009\ (x \text{ Raw Med. Ball}) + .036\ (x \text{ Raw St. Br. Jump}) - 1.4$$

Furthermore, in order to make the estimate more easily open to interpretation, the standard score can be converted to a five-point literal scale, thus:

E	D	C	B	A
− 1.8 S.D. to − 3.0 S.D.	− .6 S.D. to − 1.8 S.D.	.6 S.D. to − .6 S.D.	1.8 S.D. to .6 S.D.	3.0 S.D. to 1.8 S.D.

Conclusion

The salient feature of the factor analysis of the nine tests which sampled the physical nature of athletic ability was the emergence of a general factor. For this reason, the Holzinger technique, which gave a general and three group factors, seemed to be the more profitable statistical approach when compared with the Thurstone method which would appear in the first instance to be seeking after basic primary factors. Despite rotation, the presence of a general factor could not be concealed among the three Thurstone factors.

It is interesting, finally, to make a comparison with similar English work in this field. Factorial methods were used by Burt and his co-workers in several London schools (3). He found a well-marked general factor, closely correlated with general physical health, and special factors for strength, quickness, dexterity, steadiness, and (later) endurance.

Vernon (15) carried out work with army conscripts. His sample was more heterogeneous than the present one, and his tests included some "stunts" besides athletic performances. Despite several of his distributions being irregular or skewed and certain of his tests being admittedy vitiated by inadequacies of administration owing to weather conditions and the timing and instructions being in different hands, his results point to the existence of a general factor of athletic ability. He found three Thurstone factors and, by employing a group factor analysis based on a trial and error technique with partial correlations, discovered a general and three group factors.

TABLE 7

A Comparison of Group Factor Variances

Study	General Factor	Group Factors	Total Communality
Present data	32.0	11.7	43.7
C. Burt	35.4	18.8	54.2
P. E. Vernon	27.4	16.4	43.8
G. Highmore (1952)	30.2	23.7	53.9

More recently (1952), the present author supervised an investigation involving 110 eleven-year-old schoolboys during their first athletic season in a

secondary (modern) school in which the present battery was used, except that a 150-Yard Run and a Soccer Ball Overhead Throw-in replaced the Quarter-Mile Run and the Medicine Ball Put (8 and 9).[7] A comparison of the results reached by the group factor approach are shown in Table 7.

REFERENCES

1. AITKEN, A. C. The Evaluation of a Certain Triple-Product Matrix. *Proceedings of the Royal Society.* Edinburgh, 1937.
2. ALEXANDER, W. P. *Intelligence, Concrete and Abstract.* Brit. J. Psy. Monograph Supplement XIX. 1935.
3. BURT, SIR C. L. *Tests and Assessments of Physical Capacities.* London County Council, 1925.
4. ———. *The Factors of the Mind.* University of London Press, 1940.
5. CURETON, T. K., et al. *Endurance of Young Men.* Washington, D. C., Nat. Res. Council, Soc. for Research in Child Development, **10**: 1, 1945.
6. CURETON, T. K. *Physical Fitness Appraisal and Guidance.* St. Louis: C. V. Mosby, 1947.
7. HIGHMORE, G. Report of Research Group. *The Loughborough Journal.* No. 1. Loughborough Training College Assn., 1952.
8. ———. *An Analysis of Athletic Ability.* Unpublished memorandum obtainable from the author. 1953.
9. ——— and TAYLOR, W. R. A Factorial Analysis of Athletic Ability. *The British Journal of Statistical Psychology.* Vol. VII, Part I, May 1954.
10. HOLZINGER, K. J., and H. H. HARMON. *Factor Analysis.* Chicago: University of Chicago Press, 1941.
11. REYBURN, H. A., and J. G. TAYLOR. Some Factors of Personality. *Brit. J. Psy.*, **30**: 151-65. 1939.
12. THOMSON, SIR G. H. *The Factorial Analysis of Human Ability.* London: University of London Press, 1948.
13. THURSTONE, L. L. *Multiple Factor Analysis.* Chicago: University of Chicago Press, 1947.
14. TUCKER, L. The role of Correlated Factors in Factor Analysis. *Psychometrika*, **5**: 141-52. 1940.
15. VERNON, P. E. *An Investigation of Tests of Physical Capacities.* Unpublished memorandum, P.E.V. No. 182, April 1, 1945.
16. WHITING, H. T. A. Forecasting the Athletic Ability of the Eleven-year-old Schoolboy. *The Loughborough Journal.* No. 3 Loughborough Training College Assn., 1955.
17. WING, H. D. *Tests of Musical Ability and Appreciation.* Brit. J. Psy. Monograph Supplement XXVII. 1948.

(Submitted 5/14/55)

[7] An application of regression equations derived from this research was made a year later with 58 boys of a similar age group in the same school (16). Significant correlations with the order of merit based on the athletic achievements observed by the school Physical Education Dept. were .774 and .724.

Use of Force-Time Graphs for Performance Analysis in Facilitating Motor Learning[1]

MAXWELL L. HOWELL
University of California
Berkeley, California

Abstract

Members of one group of subjects were shown force-time graphs of their sprint start after each practice trial while members of another group were instructed by conventional procedures. Motivation was held constant; the maximum foot force was the same in both groups during the ten days of practice. The first group successfully learned the desired force-time pattern and improved considerably in speed and momentum. The second group improved very little. The results support the hypothesis that graphic analysis of the response pattern of a rapid complex motor act is a particularly effective aid to motor learning, when the graphs are made available to the person after each performance so that he can understand the physical principles involved and can visualize and correct his mistakes.

ANY COMPLEX MOTOR skill is difficult to analyze because of the lack of information about its individual components. A complex motor act usually proceeds so rapidly that it is difficult to determine exactly what has happened. If it were possible to portray graphically the responses of an individual during a motor performance, the individual could then see and correct what he had done, because he would be able to ascertain which of the responses were performed skillfully and which were not.

A type of motor response that can be investigated in detail as a result of modern improvements in apparatus is the start of a sprint race. This is a highly complicated motor act, for during the half-second that elapses between the time the gun goes off and the time the sprinter clears the blocks a number of movements occur. In this brief space of time the runner will have reacted to the starting gun, the back leg will have thrust with a pressure of perhaps 160 pounds and been swung forward, while the front foot, starting a moment later, will have exerted possibly 100 pounds of pressure for a longer fraction of time, maintained until the runner has cleared the blocks. It is impossible for a coach or a runner to analyze the start by simple unaided observation.

Recent studies have made use of a device which makes it possible to obtain a clear and continuous graphic record of the impulse exerted by each foot,

[1]From the Research Laboratory of the Department of Physical Education, University of California. The writer is now at the University of British Columbia, Vancouver, Canada. Appreciation is expressed to Professor Franklin M. Henry for the loan of the force-time chronograph and for his co-operation and advice during the study.

the manner in which that force is exerted, and the time taken to complete the individual movements. The results have shown that there is a theoretically ideal pattern of sequences characterizing the performance of good sprinters that is not ordinarily shown by inexperienced runners (5).

Review of Literature

Previous studies analyzing the sprint start have been reviewed by Henry (5). Doherty (3, *p. 47*) has given considerable historical material and some additional references. With respect to the possible value of instruction making use of an analysis of the subject's performance, there has been no adequate review or experiment.

While a number of investigators have been concerned with the benefit of providing knowledge and understanding in a learning situation, few of them have dealt with complex motor performance. Judd (9) made a study which involved the value of understanding the principles involved in hitting a target under the water with a dart. The group which was instructed in the physical principles of visual diffraction readjusted their aim rather quickly when the target was moved, while the uninstructed group had to learn all over again. Hendrickson and Schroeder (4) have confirmed this finding.

Cox (2) conducted an experiment on the transfer of manual skill after "training," contrasted to mere "practice." The manual operations studied were those involved in assembling and stripping a lamp holder. The simple practice group showed no reliable evidence of transfer, but the training group, where instruction dealt mainly with the principles of manual skill, showed a larger net gain.

Lockhart (10) gave standard instructions in bowling to two groups of freshmen college women, all beginners in this skill. The only difference in training was the use of an instructional motion picture with the experimental group. Learning, as measured by scores, was equal for the first two weeks; however, the experimental group showed steady improvement, while the control group reached a plateau at the third and fifth weeks. Also, although both groups started out with the same mean score, the experimental group showed definite superiority from the fifth week till the end of the period of observation.

A series of recent experimental studies has been concerned with the effect of motivators in increasing speed of reaction time and movement time. Measurements were made of simple reaction time (fingerpress), speed of coordinated movement (snatching a ball) and speed of a less complicated movement (treadle press). An adjustable electronic delay circuit in the apparatus was provided for administering automatically a mild electric shock or other motivating stimuli for slow responses. Application to the present investigation hinges about the question: Did improvement in reaction and movement times occur only as a result of punishment (electric shock) or did a subject's knowledge of the effectiveness of his response as given by the visual or auditory motivators cause significant improvements? The results of these studies

supported the hypothesis that the improvement was due in large measure to the informative value of the motivating stimuli, rather than to punishment as such, or to direct facilitative function (6, 7, 8).

The Problem

Specifically, the problem is to determine whether an inexperienced runner, when shown a graphic representation of the desired force-time pattern (which represents the theoretical ideal) and a similar graph which is his own performance in each trial, will make such use of the knowledge as will help him to learn the desired motor performance more effectively than is possible without this analysis of his own complex motor response.

Methodology

Apparatus. The special type of chronograph described by Henry (5) was used to record automatically the force-time graphs of the runners' pressure against the starting blocks. Since action and reaction are physically equal, such graphs afford a means of analyzing the dynamics of the start. The track was indoors, 14 yards in length, and ended against a mattress on the wall to ease the pull-up. Corrugated rubber matting was placed on the floor to prevent slippage. The subjects ran wearing gym shorts and rubber-soled shoes.
Subjects. Twenty Ss completed the experiment. Each was tested ten times. The ages ranged from 17 to 26 years, the weights from 123 to 214 pounds and the heights from 5 ft. 6 in. to 6 ft. 3 in. The men were volunteers from university physical education activity classes and had no previous track experience. It was felt that experienced track men would probably have formed habits as a result of their training and would be less inclined to change such habits for the purpose of the experiment. Moreover, it was believed that an examination of the learning curves for beginners would reveal more progress than would be seen in experienced runners.

The Ss were divided into two groups. These were given the same training except for one variable: Members of one group were shown the graphic records after each start, and the theoretical "ideal" was explained to them in terms of their own records. Members of the other group were instructed by the conventional coaching procedure as will be explained later.

The groups were equated as nearly as possible with respect to the amount of force-time impulse exerted during the first instruction period as determined by polar planimeter measurements, and also by equating according to the weights of the individuals. Any person who expressed disinterest or a lack of desire to continue was not asked to finish the series as it was felt this lack of motivation would affect the results.
Procedure. The runners practiced three times a week for a month. The total experimental periods were ten, with eight trials per period for the first five days, and 11 per period thereafter.

On the first day neither group was shown the results of their runs and both groups were given the same instructions. This gave, as far as could be ex-

perimentally controlled, a measure of the original starting levels of the groups, making it possible for the experimenter to equate the groups as explained above.

The Ss took their position in the starting blocks, and following the signals "On the mark!," "Get Set!," and "Go!" ran the length of the 14-yard track. This run was performed three times, then the Ss were tested on five starts using only a five-yard practice run and finally another three complete runs. The Ss ran on ten separate days. From the sixth until the tenth day, inclusive, there were six complete sprints at the end of the test period rather than three as outlined. The Ss, all naive with respect to start procedures, were better conditioned by this time and could run more without fatigue.

The position of the hands at the start was kept constant for each individual. The hip elevation was optimum in accordance with experimental evidence, no extremes of hip elevation being allowed. The foot spacing was kept constant at 16 inches. There was no need to alter the block spacing because of difference in leg length (5). All Ss were started with a similar technique and in accordance with recommended procedure.

The theoretically ideal performance that was emphasized to the experimental group was a particular impulse pattern that could be achieved by learning how to control the release of energy so that the foot impulse was immediate and reached its maximum on the initial thrust. As was revealed by the impulse impressions on the recording tape, this necessitated a nearly rectangular foot thrust pattern with the front foot. The physical advantage of a rectangular impulse was explained. The momentum of the runner as he cleared the starting blocks would be equal to the sum of the areas of a consecutive series of rectangles, each having a base width of a tenth-second and a height determined by the force exerted during that particular tenth second. His momentum would therefore be greatest if he exerted maximal force right from the very beginning of the foot thrust (5).

Of course, the desirability of using the back as well as the front foot was explained, but particular emphasis was placed on learning a rectangular impulse pattern with the front foot. Hence, this group attempted to improve its performance aided by explanations of what a theoretically perfect record would look like and what an individual could do to improve his performance. As a result of the inspection of the force-time impressions on the recording tape it was a simple matter for a subject to understand from each record how he had applied the force with each leg, and see his faults with respect to timing the application of this force.

Members of the second or control group were given no such theoretical knowledge. They received as much instruction as the first group, but were trained by ordinary teaching and coaching techniques. These techniques are adequately explained in such track coaching textbooks as Miller (12) and Bresnahan and Tuttle (1), and will not be given in detail.[2]

[2]A copy of the instructions may be secured from the writer.

It should be emphasized that *both* groups throughout the experiment had continuous instruction by the same person, an instructor who had two years' experience as a high school track coach. Each member of the control group was motivated throughout the experiment by directing attention to the starting form from the point of view of a physical education teacher or coach, as to the manner in which he started, including hip elevation, arm thrust, head and eye position, foot movement, body elevation, thrusting away from the blocks, and so on. It was believed that the motivation factor was constant for both groups, and evidence will be given to justify that belief. Both groups had instruction day by day. The difference between the groups was that the members of one group knew their faults by examination of the records of starting pattern, whereas the members of the other group knew their faults from constructive criticism and appraisals of the form of each individual from the point of view of prevailing physical education track teaching.

Measurements. The last run of each individual on each day (in both groups) was examined to see how well each one approximated the ideal rectangular impulse pattern. To determine this, the base length of each impulse tracing on the chronograph and also its maximum height were used to draw a theoretically perfect rectangular area representing the maximum possible number of force-time units for a particular front foot impulse. The areas of the *actual* impulse pattern and the rectangular "maximum," were then determined by measuring with a polar planimeter. The discrepancy between the theoretical ideal for each impulse and the actual impulse pattern was the discrepancy score, which would approach zero as learning progressed, as may be seen in Figure I. The discrepancy score for the control group on Day 2 is shown as a cross-hatched area in this figure.

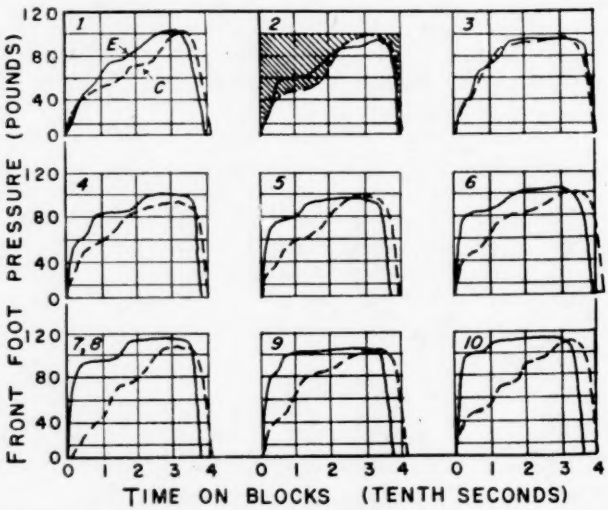

FIGURE I. Day-by-Day Graphs of Average Force-Time Impulse.

Experimental Results and Discussion

Learning of Front Foot Pattern. The amount of learning was found to be quite large in the experimental group. The progressive improvement can be seen pictorially in Figure I. In this figure, the individual curves have been averaged by the graphic method described by Henry (5). The curves for the experimental group (E) appear as solid lines, while the control group curves (C) are drawn with dashes. Since the graphs for Days 7 and 8 were almost identical, they have been averaged in the figure in order to save space.

The development in the experimental group appears to have been from the irregular pattern that characterizes the inexperienced runner to an immediate hard thrust followed by a short plateau and then an increase in thrust to the maximum pressure which is held until the runner clears the blocks. The latter pattern is characteristic of champion sprint runners who have had several years of competitive experience, but no specific training by any force-time analysis (5). Of course certain individuals achieved the theoretical ideal at earlier times during the training than others, and some were more consistent than others. The control group made little progress toward achieving the ideal rectangular pattern.

Making a numerical analysis, the per cent improvement in discrepancy scores in the experimental group (using the discrepancy score of the first day as a reference level) was 33.5 per cent gain on the second day and 36.5 per cent gain on the third day. On the fourth day the improvement jumped to 57.4 per cent, on the fifth day it had advanced to 64.4 per cent, and had reached 74.4 per cent improvement on the sixth day. During the next three days the improvement dropped back somewhat, to 66.1 per cent on the seventh day, to 59.2 per cent on the eighth day and to 65.9 per cent on the ninth day. On the tenth day the improvement was greater than on any of the previous days, being 77.2 per cent. The control group did not show any trend toward improvement. (See Figure II, which shows the learning curves of the two groups.)

The results were analyzed day by day to see if there were any statistically significant differences between the experimental and control groups (see Table 1). The proper statistical evaluation for the problem requires the use of the one-tailed type of t distribution, because the hypothesis being tested predicts the direction of the difference. With ten Ss in each group, a t ratio of 1.73 would be significant at the 5-per-cent level of confidence; a ratio of 2.55 would be significant at the 1-per-cent level.

There were no significant differences for the first three days of practice. However, by the last run of the fourth day, the effects of the learning situation had become more clear-cut. The mean difference between the experimental and control group increased to 5.17 and the t ratio was 2.77 (significant at the 1-per-cent level). Since the instructions of this group emphasized the physical principles involved and stressed analyzing the actual response and comparing it with the theoretically ideal graph, it seems likely

that the greater improvement of this group is related to the special instruction that they received.

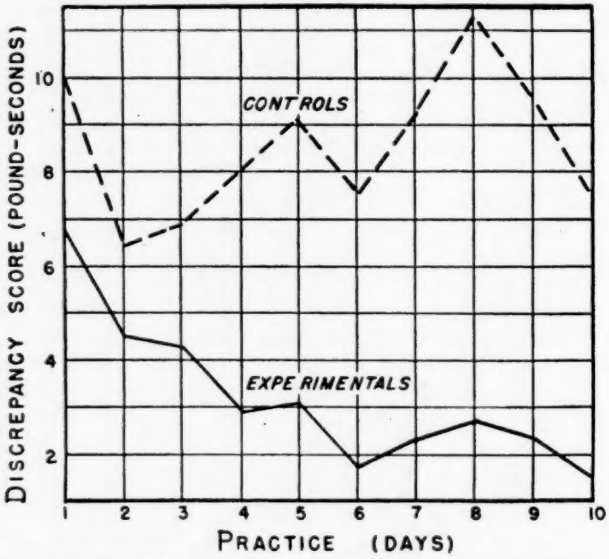

FIGURE II. Reduction in Discrepancy Scores as Learning Progresses.

TABLE 1

Comparison of Experimental and Control Groups as to Discrepancy Between Observed and Rectangular Pattern

Day	Experimental Group		Control Group		Difference	
	Mean	S.D.	Mean	S.D.	Diff.	t ratio[1]
1	6.81	6.40	10.38	6.14	3.57	1.20
2	4.53	4.36	6.44	4.21	1.91	0.94
3	4.35	4.52	6.91	4.25	2.56	1.23
4	2.91	2.77	8.08	4.85	5.17	2.77
5	3.11	3.08	9.15	5.62	6.04	2.83
6	1.77	2.41	7.52	4.02	5.75	3.66
7	2.40	2.08	9.34	3.93	6.94	4.68
8	2.78	2.37	11.35	3.95	8.57	5.58
9	2.35	2.30	9.59	5.69	7.24	3.54
10	1.56	1.57	7.58	4.07	6.02	4.26

[1]Since the two groups were not paired as to individuals, the correlation has been assumed to be zero.

The greater effectiveness of the experimental learning process remained consistently evident after the fourth day. On the last run of the fifth day the t ratio between the groups was 2.83, and on the last run of the sixth day it was

3.66. On the seventh day it was even higher: $t = 4.68$. The mean difference between the two groups in this particular trial was 6.94. The largest t ratio occurred on the eighth day ($t = 5.58$). The mean difference between the two groups was also the highest, being 8.57. At the ninth day there was a decline to $t = 3.54$, and on the last run of the final day it was 4.26. Beginning with the fourth day of practice, the differences between groups were therefore highly significant.

While the groups were not perfectly equated on discrepancy scores at the start (they were matched for weight and impulse), the results are statistically acceptable. McNemar (11, *p. 355*) has shown that "if, for example, a chance, i.e., statistically non-significant difference exists in the initial mean . . . scores of two groups, this difference, in and of itself will not lead to a significant difference in the extent to which they will profit from the diverse methods of teaching improvement. . . ." One can be conservative and subtract the average of the first three differences, which were non-significant, from the observed differences for the later days. When this was done, the differences for the last five days were still statistically significant, the t's ranging from 1.95 for the sixth day to 3.93 for the eighth day.

Control of Motivational Differences. Particular effort was directed to keep the motivation equal in the experimental and control groups. Nevertheless, it might be argued that the special instructions caused the members of the experimental group to be more highly motivated. If this were so, they would be expected to produce a harder foot thrust than the controls, regardless of the discrepancy score. The analysis fails to sustain the argument. The difference between the two groups in this respect never became statistically significant. It can be seen in Figure I that the maximum force exerted was remarkably similar in the two groups throughout the experiment. It is therefore unlikely that motivational differences had any important influence.

Effect of Practice on Impulse Exerted by Both Feet. An interesting consideration, although not the primary one, was whether the amount of impulse exerted by both feet revealed a significant improvement in total magnitude, regardless of form, as a result of practice by the experimental and control groups. The instructional emphasis had been related only to the learning of the correct form, that is the theoretically correct impulse pattern, without any explicit consideration or emphasis on increasing the force exerted over the initial day's run. In practical application, attention would be directed toward emphasizing the importance of increasing the forcefulness of the start (stage 2) after the correct form (stage 1) had been achieved. After this, there would be increased emphasis on developing a strong stride (stage 3) to improve the total sprint time.

While the present experiment was limited to stage 1, improvement in the runner's speed as he left the blocks would be expected in both groups. This speed can easily be calculated (5) since from the laws of simple physics it is equal to the total force-time impulse in pound-seconds, divided by the mass of the runner in slugs. (A *slug* is defined as the weight of the runner in

pounds, divided by the gravitational constant which is 32 ft/sec). The average mass of the experimental group was 5.26 slugs; of the control group, 4.85 slugs.

The average starting impulse in pound-seconds, for the sum of the two feet, was 32.8 (S.D. = 7.00) in the experimental group and 30.0 (S.D. = 6.54) in the controls on Day 1. It increased to 37.9 (S.D. = 7.66) in the experimentals and dropped slightly to 29.7 (S.D. = 8.08) in the controls on Day 10. When these figures are converted to speed of the runner as he clears the starting blocks, we see that on Day 1 the experimentals had a velocity of 6.24 ft/sec compared with 6.18 ft/sec for the controls. This is almost perfect matching; the difference is less than 1 per cent. On Day 10 the experimentals had increased 15.7 per cent to a speed of 7.22 ft/sec, while the controls remained at 6.13 ft/sec. The two groups did not differ significantly on Day 1 ($t = 0.35$), but did on Day 10 ($t = 2.21$). The members of the experimental group, as a result of practice, were able to achieve a starting block velocity almost equal to that reported by Henry (5), namely 7.3 ft/sec, while the controls even on their best day never got faster than 6.6 ft/sec and were always considerably slower than the experimentals on each day's testing, particularly after the third day.

TABLE 2

Improvement in Total Force-Time Starting Impulse with Practice
(The score on Day 1 is used as the base)

Practice Days	Experimental Group			Control Group		
	Mean	S.D.	t ratio	Mean	S.D.	t ratio
2	2.31	0.88	8.0	1.57	0.95	5.0
3	3.39	1.01	10.1	2.19	0.94	6.8
4	4.08	1.17	10.3	−0.39	1.21	1.0
5	4.30	1.21	10.7	0.13	1.14	0.3
6	3.65	1.21	9.2	−0.42	1.04	1.2
7	2.94	1.34	6.7	−0.19	1.33	0.4
8	4.89	1.47	10.0	−0.29	1.24	0.7
9	4.73	1.47	9.8	1.99	1.17	4.9
10	5.38	1.66	9.8	−0.36	1.24	0.9

Table 2 gives the improvement (learning) using the force-time impulse of the two feet combined for each day's practice after the first. Both groups made highly significant improvements on days 2 and 3. The improvement was greater in the experimental group, and it continued with some irregularity up through the tenth day of practice. The control group made their best score on the third day of practice, and were approximately that good on the ninth day. On other days, they did no better than their first day's performance. With more practice, they would probably recapture the improvement exhibited on days 2, 3 and 9, but it is clearly seen that their improvement was not nearly as good as was found in the experimental group.

Summary and Conclusions

Two groups of inexperienced university students (10 men in each) were given ten days of practice in sprint starting. Eight to 11 trials were made each day, three days per week. One group (control) was given detailed instruction by the conventional method of explanation commonly used in coaching. The other group (experimental) was instructed by showing a force-time graph of the observed starting pattern after each trial, and explaining the principles of physics involved in the theoretically correct start. An attempt was made to equalize the motivational factors, which was evidently successful since the maximum force exerted in the foot thrust was almost exactly the same in the two groups throughout the experiment.

The apparatus consisted of spring-loaded starting blocks connected mechanically to a chronograph equipped with ink pens, which automatically drew a graph of the force exerted as a function of time in units of 0.01 sec. Learning scores were computed as the discrepancy between the theoretically correct force-time pattern of the front foot and the pattern observed on the last trial of each day's practice.

It was found that the experimental group progressed steadily toward the desired performance during the first six days of practice, and fluctuated narrowly about this plateau during the remainder of the practice periods. The control group failed to improve their discrepancy scores, and were noticeably more variable in performance. Differences between the groups were highly significant on all practice days after the third.

Since action and reaction are equal, it was possible to compute the momentum and speed of the runners at the instant they cleared the starting blocks, by using the sum of the force-time impulses of the two feet. The experimental group showed a highly significant improvement which was maintained, while the control group average was slower on five subsequent days than on the first day of practice. On three days (the second, third and ninth) the controls were significantly faster than on the first day. Hence, they were both slower and more irregular in performance than the subjects instructed by the experimental method.

The results support the hypothesis that graphic analysis of the response pattern of a complex rapid motor act such as the sprint start, made available to the subject immediately after each performance so that he can visualize what he did wrong and correct his mistakes, and can understand the physical principles involved, is a particularly effective aid to motor learning.

REFERENCES

1. Bresnahan, G. T., and W. W. Tuttle, *Track and Field Athletics*, St. Louis: C. V. Mosby Co., 1947.
2. Cox, J. W., Some experiments on formal training in the acquisition of skill. *British Jour. Psychol.*, **24**: 67-87, 1933.
3. Doherty, J. K., *Modern Track and Field*. New York: Prentice-Hall, Inc., 1953.
4. Hendrickson, G., and W. H. Schroeder, Transfer of training in learning to hit a submerged target. *Jour. Educ. Psychol.*, **32**: 205-213, 1941.

5. HENRY, F. M., Force-time characteristics of the sprint start. *Research Quarterly*, **23**: 301-318, 1952.
6. ———, Independence of reaction and movement times and equivalence of sensory motivators of faster response. *Research Quarterly*, **23**: 43-54, 1952.
7. HIPPLE, J. E., Racial differences in the influence of motivation on muscular tension, reaction time and speed of movement. *Research Quarterly*, **25**: 297-306, 1954.
8. HOWELL, M. L., Influence of emotional tension on speed of reaction and movement. *Research Quarterly*, **24**: 22-32, 1953.
9. JUDD, C. H., The relation of special training to general intelligence. *Educ. Rev.*, **36**: 28-42, 1908.
10. LOCKHART, AILEENE, The value of the motion picture as an instructional device in learning a motor skill. *Research Quarterly*, **15**: 181-187, 1944.
11. MCNEMAR, Q., Sampling in psychological research. *Psychol. Bul.*, **37**: 331-365, 1940.
12. MILLER, R. I., *Fundamentals of Track and Field Coaching*. New York: McGraw-Hill Co., 1952.

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Physical Education Teachers' Contributions to Guidance in Minnesota Secondary Schools

ELOISE M. JAEGER AND HELEN M. SLOCUM
University of Minnesota
Minneapolis

Abstract

The objectives of this study were to determine the assigned ranks of general problem areas based on frequency of occurrence, the specific kinds of student problems encountered within the areas, the frequency with which specific problems were encountered, and the extent to which physical education teachers participated in more formal guidance activities. A total of 691 (77%) of 897 questionnaires were returned. The findings showed that students do come to their physical education teachers with a great variety of problems, and that a large percentage of physical education teachers carry responsibilities in connection with the more formal guidance activities of the school.

THE GYMNASIUMS and athletic fields have been considered natural laboratories for the observation of normal reactions of boys and girls. The informal relationship which generally exists between the physical education teacher and his students has been the basis for assuming that this field can contribute much in the area of guidance. However, a review of the literature revealed no studies which would substantiate such claims. As a result, the writers decided to survey the physical education teachers of Minnesota to obtain some objective information dealing with this problem.[1]

The principal objectives of this survey were to determine the assigned ranks of general problem areas based on frequency of occurrence, the specific kinds of student problems encountered within these areas, the frequency with which such specific problems were encountered, and the extent to which physical education teachers participated in more formal guidance activities. Implications of the findings should be useful for teacher training institutions and in-service teacher programs in the State.

Procedure

A questionnaire prepared by the writers was sent out to all men and women teachers classified as either a major or minor in the field of physical education in the secondary schools of Minnesota. A total of 897 questionnaires were distributed and 691 (77%) were returned. This percentage of returns was considered adequate. Information was not available on nonrespondents. Percentage of responses for the four groups were as follows: men majors,

[1]This study was co-sponsored by the Department of Physical Education for Women and the Bureau of Educational Research, University of Minnesota.

74.3%; men minors, 77.6%; women majors, 81.5%; women minors, 76.6%. A follow-up letter and two postcards were sent to all nonrespondents.

The questionnaire was divided into four sections. Sections A, B, and C described various problems with which the physical education teacher may be confronted. These problems were grouped under seven areas: (1) Health and Physical Development; (2) School Adjustment; (3) Finances; (4) Home and Family Life; (5) Social and Recreational Life; (6) Personal, Emotional and Social Adjustment; (7) Vocational Guidance.

Various kinds of problems were listed under each problem area. The respondent was asked to classify each problem found in the lists into one of these three types: Write 1 if the problem is one about which individual pupils have *not* talked to you; Write 2 if the problem is *neither type 1 or 3* which individual pupils discuss with you, but it does not require as much of your time as specified in 3; Write 3 if the problem is one of those few for which your work with individual pupils takes an average of *one hour or more per month.* Spaces were provided at the end of each list for the respondents to indicate other problems not listed.

Section D listed the seven problem areas alphabetically, and the respondents were asked to rate each area in terms of importance from the standpoint of *questions asked most frequently by students.* Section D also asked the respondent to indicate by code number the grade level at which he now taught; the total number of students attending the secondary school in which he taught; and to indicate whether he taught physical education only, physical education and health education only, physical education, health education and other subjects, physical education and other subjects, excluding health education. In addition, this section asked teachers to indicate their participation or non participation in a number of more formal guidance activities.

Analysis of the Data

The first step in the analysis of the data was that of determining the ranking of the problem areas according to each of the following categories: (1) teaching classification (major or minor); (2) grade level taught; (3) size of school; (4) subjects taught.

When men majors were compared with women majors (Table 1), it was found that both groups ranked the areas Personal, Emotional and Social Development, Health and Physical Development, and Social and Recreational Life among the first three. Boys were more concerned with their own health and physical development while girls gave first attention to personal, emotional, and social development. Home and Family Life, Vocational Choice, and Finances ranked among the three lowest in the problem areas for both sexes.

It is also interesting to note that when the rankings of the women majors were compared with those of women minors, rankings appeared in identical order. Men majors and men minors compared quite closely although Health and Physical Development was rated number one by the majors but received

TABLE 1

Rank of Problem Areas by Men and Women Majors and Minors in Physical Education

Problem Areas	Men Majors (N-355)	Men Minors (N-87)	Women Majors (N-204)	Women Minors (N-49)
Finances	6	6	7	7
Health and Physical Development	1	4	3	3
Home and Family Life	7	7	5	5
Personal, Emotional, and Social Development	3	2	1	1
School Adjustment	5	5	4	4
Social and Recreational Life	2	1	2	2
Vocational Choice	4	3	6	6

a rank of four by the minors. It may be that men with a major in the field carried heavier coaching assignments and were thus confronted with more problems in this area.

When the ranking of the problem areas according to grade level taught was studied (Table 2), certain differences became apparent. Health and Physical Development was evidently of more concern during the junior high school years than during senior high school, and Vocational Choice definitely became more important at the senior high school level. Regardless of the grade level, Health and Physical Development, Personal, Emotional and Social Development, and Social and Recreational Life remained "top" problems; while Home and Family Life, School Adjustment, and Finances comprised the lowest three areas.

TABLE 2

Rank of Problem Areas According to Grade Levels Taught (Men and Women Combined)

Problem Areas	Jr. Hi. Grades 7-9 (N-113)	Jr.-Sr. Hi. 7-12 (N-116)	Sr. Hi. 10-12; 9-12 (N-440)	Other Grade Levels (N-12)
Finances	7	7	6	7
Health and Physical Development	1	3	2	2
Home and Family Life	5	6	7	6
Personal, Emotional, and Social Development	2	1	1	3 (tie)
School Adjustment	4	4	5	5
Social and Recreational Life	3	2	4	1
Vocational Choice	6	5	3	3 (tie)

Size of school did not have too great a bearing on the ranking of the problems that appeared troublesome to boys and girls. With the exception of the schools with 2,000 population and over, only a slight variation existed (Table 3). It was found that problems in Health and Physical Development increased slightly in importance as the size of the school increased. Social and Recreational Life was judged to be more of a problem in the smaller schools.

TABLE 3
Rank of Problem Areas According to the Size of School

Problem Areas	Total No. Students Attending Secondary School (Men and Women Combined)					
	Less than 100 (N-54)	101-300 (N-250)	301-500 (N-123)	501-1000 (N-157)	1001-2000 (N-84)	More than 2000 (N-5)
Finances	6	7	7	7	7	6
Health and Physical Development	3	3	2	2	1	3
Home and Family Life	7	6	6	6	6	4
Personal, Emotional, and Social Development	2	2	1	1	2	1
School Adjustment	5	5	4	4	3	4
Social and Recreational Life	1	1	3	3	3	2
Vocational Choice	4	4	5	5	5	7

Fairly close agreement existed when the rank of problem areas according to subjects taught was examined (Table 4). As might be anticipated, Health and Physical Development appeared as a number one problem for those who taught physical education exclusively, as against a ranking of three for those who taught other subjects in addition to health and physical education. On the other hand, respondents who taught subjects outside the field of health and physical education ranked Social and Recreational Life as the most important problem to their students. This finding agreed with the results presented in Table 3, where the same problem was of prime importance to the schools of 300 and less students. In other words, one would expect that those who taught several different subjects would be more apt to be located in the smaller school.

TABLE 4
Rank of Problem Areas According to Subjects Taught

Problem Areas	Phys. Ed. Only (N-124)	Phys. Ed. & Health Ed. Only (N-142)	Phys. Ed., Health Ed., & Other Subjects (N-224)	Phys. Ed. & Other Subjects, excl. Health Ed. (N-196)
Finances	7	7	7	7
Health and Physical Development	1	2	3	3
Home and Family Life	5	6	6	6
Personal, Emotional, and Social Development	2	1	2	2
School Adjustment	3	3	4	5
Social and Recreational Life	3	3	1	1
Vocational Choice	6	5	5	4

One rather surprising finding was that those teaching health and physical education classified School Adjustment problems to be of greater importance

than did teachers carrying academic assignments. It may be that students feel more free about discussing school work with someone whom they do not associate with the classroom setting. The problem of Vocational Choice gained in importance as the number of subjects taught increased. Physical education teachers ranked it sixth as against four for teachers who taught physical education and other subjects, excluding health education. This finding appeared reasonable in view of the fact that additional subjects included social studies, business and commercial work, industrial arts, and home economics. In these areas, planned vocational guidance constitutes part of the course work.

Discussion

Tables 5 and 6 show the problems most frequently encountered by those teachers who stated that *one or more hours a month* were devoted to them.

TABLE 5

Rank of Problem Areas Given by Men Physical Education Majors and Problems Most Frequently Encountered Within Each Area

Problem Areas	Rank	Most Frequently Encountered Problems	% of Teachers Devoting One or More Hrs. per Mo. (N-355)
Health and Physical Development	1	a-b. Physically awkward	29
		Posture faults	29
		c. Sore throat, colds, sinus	26
Social and Recreational Life	2	a. Lack of recreational skills	30
		b. Failing to have fun at school functions	17
		c. Ill-at-ease at school functions	14
Personal, Emotional, and Social Development	3	a. Fear of making mistakes	20
		b-c. Feeling of inferiority	19
		Lack of self-confidence	19
Vocational Choice	4	a. Difficulty in making vocational choice	40
		b. Wanting to be out of school and on own	31
		c. Need to know vocational abilities	19
School Adjustment	5	a. Poor school facilities	24
		b. Inabilty to get lessons done	22
		c. Fear of low grades	21
Finances	6	a. Financing a post-high-school education	23
		b. Necessity of working part time	18
Home and Family Life	7	a-b-c. Illness in family	9
		Separation of parents	9
		Unhappy home life	9

TABLE 6

Rank of Problem Areas Given by Women Physical Education Majors and Problems Most Frequently Encountered Within Each Area

Problem Areas	Rank	Most Frequently Encountered Problems	% of Teachers Devoting One or More Hrs. per Mo. (N-204)
Personal, Emotional, and Social Development	1	a. Personal faults, jealousy, etc.	22
		b. Problems pertaining to dating	21
		c. Lack of self-confidence	19
Social and Recreational Life	2	a. Lack of recreational skills: dancing, etc.	29
		b. Failing to have fun at school functions	13
		c. Not knowing how to act on a date	12
Health and Physical Development	3	a. Menstrual disturbance	45
		b. Posture faults	44
		c. Weight control	40
School Adjustment	4	a. Fear of low grades	18
		b. Inability to get lessons done	15
		c. Poor school facilities	15
Home and Family Life	5	a. Poor child-parent relationship	14
		b-c. Fear of parental criticism	11
		Unhappy home life	11
Vocational Choice	6	a. Difficulty in making vocational choice	31
		b. Wanting to be out of school and on his own	20
Finances	7	a. Financing post-high-school education	15
		b. Necessity for working part time	11

The findings are based on the results obtained from men and women majors in the field. Actually, men and women were confronted with many of the same problems since very close agreement can be seen when individual problems are studied under each problem area. That is, the same problems occurred in approximately the same rank order for each area. The study of individual problems also shows that 40 per cent of the men (the highest figure reported) spent one or more hours per month helping students with problems concerning Vocational Choice and 40-45 per cent of the women (the highest figure reported) spend one or more hours per month on problems of Health and Physical Development. At first, it might appear to the reader as though this is in opposition to the previous finding in which men majors

ranked Health and Physical Development first and women majors ranked Personal, Emotional, and Social Development as a first. The explanation may be that, while a larger percentage of men and women spend *one or more hours per month* on the problems previously enumerated, they have a greater *number* of problems arising in the areas of Health and Physical Development and Personal, Emotional, and Social Development, and consequently ranked these areas as being the most important ones.

With respect to *most frequently mentioned problems but requiring less than one hour a month*, it was found that 50-80 per cent of the teachers reported complexion, defective eyesight, fatigue, headaches, instructors unfair, too much work required by some teachers, and illness in the family as other problems troublesome to the student.

Section D was concerned with the more formal guidance procedures performed by the teachers included in this study. A very high percentage (87%) of men and women majors (Table 7) indicated that classroom teachers consulted them regarding the habits and reactions of pupils in the gymnasium.

TABLE 7

Percentage of Men and Women Physical Education Teachers Giving an Affirmative Answer to Questions Dealing with More Formal Guidance Activities

Question	Teacher Category			
	Men Majors (N-355)	Men Minors (N-87)	Women Majors (N-204)	Women Minors (N-49)
a. Do you act as an adviser to a home room?	50	65		59
b. Do you act as an adviser to an entire class, i.e., all the freshmen, sophomores, juniors or seniors in the school?	50	68	41 36	63
c. Do you act in the capacity of Dean of Boys or Dean of Girls?	3	1	4	8
d. Do you have a regularly assigned responsibility in the administration of the psychological testing program?	10	26	8	24
e. Do you have a regularly assigned responsibility in the interpretation of the psychological testing program?	8	20	6	16
f. Do you find that classroom teachers consult you regarding the habits and reactions of pupils in the gymnasium?	88	82	86	78
g. Are you called in as a member of an individual pupil case conference at least once a semester?	67	71	62	67
h. Do you serve on special committees such as scholarships, discipline, etc., that have to do with the guidance and welfare of the students in your school?	60	60	49	47

Sixty-five per cent of this same group indicated that they were called in at a number of individual pupil case conferences at least once a semester. Men

apparently carried more responsibility as advisers and members of special committees than did the women. Although the number of men and women carrying responsibility for the administration and interpretation of the psychological testing program was very small, some did contribute to this part of the guidance program. On the other hand, men and women minors assumed greater responsibility than did majors when it came to acting as advisers and administering and interpreting the psychological testing program.

Summary and Conclusions

A detailed questionnaire was sent to all secondary physical education teachers in Minnesota to obtain objective information on the number and kinds of student problems encountered by teachers in this field. Based on total returns of 77 per cent, the ranks of student problem areas were ascertained for men and women, majors and minors in physical education. Specific problems of importance within these areas were noted based on the percentage of teachers devoting one or more hours per month to a particular problem. The extent to which physical education teachers participated in more formal guidance activities was also pointed out.

The detailed findings of the survey suggest the following general conclusions with respect to physical education teachers of Minnesota:

1. Students do come to their physical education teacher with a great variety of personal problems.
2. Problems involving Health and Physical Development, Personal, Social, and Emotional Development, and Social and Recreational Life constitute the more important areas.
3. Size of school and grade level taught appear to be of minor importance in determining the rank of problem areas.
4. A large percentage of physical education teachers are called upon to confer with classroom teachers, serve as members of individual case conferences, serve as members of special committees and carry advisory functions. About one-third to one-half of the physical education teachers carry some responsibility with regard to home room and class advising. A small few assume responsibility for some part of the psychological testing program.

Recommendations

On the basis of the findings of this survey, the following recommendations are made:

1. That schools preparing teachers of physical education make an increased effort to help the prospective teacher recognize the many and varied responsibilities that he will assume as a teacher of this profession.
2. That prospective teachers undertake work in the areas of biolgical science, human growth and development, psychology, social science, and school health education that will help prepare him to better meet the needs and problems of boys and girls.

3. That the prospective teachers of physical education clearly understand their function in helping boys and girls with their problems. Perhaps the most important function being to recognize when he, as a teacher, needs the service of the guidance specialist in the school, and when and how to direct pupils in need of expert counseling.

REFERENCES

1. ANDREWS, E. G., Guidance Survey of Student Problems, *Education and Psychology*, M 4, No. 3: 209-215, 1944.
2. GRANT, B., Survey Study on Problems of the Adolescent, *Calif. Jl. of Secondary Education*, **28**: 293-7, March 1953.
3. LABRANT, L. L. and M. WILLIS, Some Problems of Adolescents, *Mental Health in the Classroom*, 30th Yearbook (NEA Dept. of Supervision and Curriculum Development), pp. 174-187.
4. MORISEN, LUELLA J., Problem Check List Form for Schools of Nursing, Bureau of Educational Research, Ohio State University, Columbus, Ohio, 1945.
5. NORTEN, S. K., Student Problems Met by the Teacher, *School Review*, **56**: 404-9, Sept. 1948.
6. WILLIAMS, C., JR., Students' Viewpoints About Health, Financial, Vocational and Personality Problems, *School Review*, **62**: 45-9, Jan. 1954.

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Job Analysis of Women Supervisors of Physical Education in United States Public Schools[1]

HELEN T. MACKEY
State Teachers College at Salem
Salem, Massachusetts

Abstract

This study identifies 157 duties concluded to be descriptive of all phases of the job of women supervisors of physical education in small, medium, and large elementary and secondary public schools of the United States. Duties were rated as to their *frequency* of performance, *difficulty* and relative *importance*, and as to time devoted to various phases of the job. Certain duties rated high in all criteria; namely, *Frequency, Difficulty*, and *Importance*. Other duties were shown to be considered important or difficult, but for some reason infrequently performed. In such cases, factors affecting job performance were indicated.

INDUSTRIAL MANAGEMENT has found that analysis of jobs in industry can improve hiring techniques, training and rating methods, job descriptions, and job performance (2, 3, 5, 18, 20, 21). Following industry's lead, education, too, is making use of job analyses to obtain more specific knowledge of school job functions with the aim of improving training and supervisory practices, and of pointing the way to better job performance (4, 6, 7, 8, 12, 13, 17, 19). Several research studies pertain particularly to the work of health and physical education (10, 11, 14, 15, 16).

Purposes of the Study

The purposes of this study were:

1. To identify the duties that make up the job of a woman physical education supervisor.
2. To analyze the duties of the supervisor as to the:
   a. Frequency of the duties
   b. Difficulty of the duties
   c. Relative importance of the duties
   d. Time devoted to the units of duties
3. Individual reasons for certain responses which indicate importance, but infrequency of a duty.

It was felt that through this identification and analysis, administrators might procure a better understanding of what the woman physical education supervisor's job involves. Implications might also be discovered for desirable curriculum emphases based upon current needs, and for the purpose of im-

[1]This study was made in partial fulfillment of the requirements for a Doctor's degree at Boston University School of Education, June 1954.

proving training of women physical education supervisors in elementary and secondary public schools.

Procedure

To accomplish the purposes of the study, four techniques—documentary analysis, introspection, the personal interview, and the checklist—were used in the development of the list of duties.

As duties were identified in the documentary analysis, which included books, periodicals, bulletins, monographs, theses, and dissertations, they were recorded on cards. During the course of the investigation, the card file of duties was in constant development, personal experience being one basis for combining, classifying, deleting, restating, and eventual organizing of the list into one which would be comprehensive, yet not overdetailed, repetitious, or unduly formidable to study participants.

In order to modify and extend the list of duties collected through documentary analysis and introspection, personal interviews were held with ten women physical educators in five states, all of whom had had extensive experience in the supervision of women's physical education. Following each interview, additional duties were added, changes made in wording, and many dutes considered unimportant deleted.

The checklist, which was the fourth step employed to complete the list of duties, was developed from the materials provided through literature analysis, introspection, and personal interviews.

The methods of documentary analysis, introspection, and personal interviews yielded 427 possible duties which were tentatively classified under the following categories, felt to be functional in the work performed by women public school physical education supervisors:

1. Administrative duties
2. Duties pertaining to plant, equipment, facilities and supplies
3. Instructional duties
4. Duties pertaining to community activities
5. Co-curricular or extra-class duties
6. Duties pertaining to special services and activities
7. Interscholastic athletics
8. Supervisory duties
9. Duties concerned with personal professional or professional contributions

During the period of construction of a tentative rating scale to be used in a tryout study, the following criteria were kept in mind:

1. The duties should be those which would be applicable to women physical education supervisors in public schools of varying sizes and types.

2. The duties should reflect all phases of the position of the woman physical education supervisor as defined in this study.

3. The list should be short enough to be practical, yet long enough to be inclusive of all duties pertinent to the position.

For use in the tryout checklist, the preliminary lists of duties were reduced to 29 administrative duties; 13 pertaining to plant, equipment, facilities and

supplies; 19 instructional; 16 relating to community activities; 12 co-curricular or extra-class; 9 special services and activities; 13 pertaining to interscholastic athletics; 26 supervisory; and 20 personal professional and professional contributions—making a total of 157 duties.

A tentative rating scale provided for the duties to be evaluated as to their *frequency of performance* on a five-point scale, as follows:

5—Very Frequently—a duty performed once or more a week.
4—Frequently—a duty performed once or more in two weeks but not as often as once a week.
3—Occasionally—a duty performed once or more a month but not as often as once in two weeks.
2—Infrequently—a duty which is performed once or twice a year.
1—Not Performed—a duty which you do not perform personally in your position.

The criterion of *difficulty* was based on a scale of five degrees as follows:

5—Extreme
4—Considerable
3—Moderate
2—Some
1—Little or None
x—Not Qualified to Rate

It was suggested to the participants that duties not performed not be rated for *difficulty*.

The criterion *importance* carried a rating scale of five degrees, as follows:

5—Extreme
4—Considerable
3—Moderate
2—Some
1—Little or None

It was suggested to the raters that the duties might be rated for *importance* even though not performed, since the rater might attach some degree of importance to a duty and should give it a rating, if the rater felt qualified to do so.

In the tryout study, *factors affecting performance* were enumerated as follows:

1. Administrative policy
2. Lack of space and facilities
3. Inadequate training
4. Financial
5. Time limitations
6. Personal preference
7. Other staff member
8. Lack of understanding by parents and pupils
9. Pressure for interschool competition
10. Other

Respondents were asked to state a percentage estimate of the time actually consumed in the performance of each of the nine classifications of duties, an estimate of the percentage of time recommended for performance, and the approximate number of hours spent on the job each week.

The tentative rating scale was submitted to the test of a preliminary tryout, not, as yet, to verify reliability of the items, but rather to determine the clarity with which the duties had been identified, to determine whether supervisors in varying localities and in communities of varying size might furnish additional duties, and to elicit any ideas which the raters might have for improvement of the checklist. Returns from 19 representative supervisors in all geographical sections of the United States and in various sized communities made evident that the list of duties was comprehensive: only one duty was suggested as additional.

It was decided to try the same tentative form with a larger group of supervisors with an extended geographical coverage, for the special purpose of determining to some degree possible indications of reliability of the rating scale, and to secure any other reactions the respondents might have as to improvement and refinement of the instrument.

It was determined that a sampling of 50 items of the checklist might serve these purposes in this preliminary stage of the study. Twenty-six supervisors in 23 states, representing communities with populations *over 100,000; 50,000-100,000; 25,000-50,000; 15,000-25,000; 5,000-15,000* and *under 5,000* returned the checklist; rerating of the indicated items resulted in a correlation coefficient (Pearson product moment computing method) of .801 $\pm$ .06. In consideration of the fact that the format of the instrument had been somewhat changed, although the sampled items were identical, this was felt to be partial indication of reliability; however, another reliability check followed.

On the basis of the 50-item sampling tryout, several revisions were made to improve the checklist. Certain duties were eliminated, combined, or restated; directions were simplified and rearranged for greater clarity. The *Factors Affecting Performance* were stated alphabetically, as follows:

Administrative policy
Budget—finances
Competition, inter-school
Education, training
Facilities, space
Personal preference
Staff member, members
Time element
Understanding of program, aims, by parents, pupils
Other, not listed

The entire instrument was arranged more compactly, and the total pages reduced.

The revised form (which later proved to be the final form) was mailed to 50 supervisors, and after the passage of a month, these 50 respondents were asked to complete the identical form again. Thirty-two supervisors from twenty states representing large, medium, and small communities returned the final form a second time. On the basis of the total scores, the reliability of the first and second rating scales was determined by computing the coefficient of correlation of .862 $\pm$ .04 showed a marked to high degree of rela-

tionship between the first and second ratings and appeared adequate for purposes of this research.

The final revision of the checklist, containing 157 duties, is on file in the original doctoral dissertation; copies will be sent by the author to those interested.

Assistance in selection of qualified women supervisors to rate the duties was secured from the membership roster of the Society of State Directors of Health, Physical Education, and Recreation and from the United States Office of Education. Women supervisors of physical education in 43 states (100% of those employing women physical education supervisors) recommended by the state directors as those "carrying on the best practices in this area and who have demonstrated genuine professional interest" participated in the study. Of the 407 recommended for participation, 346, or slightly more than 84 per cent of the supervisors responded; 217, or 78 per cent of the returned checklist were deemed usable for the study.

The 217 women physical education supervisors were separated into 18 different categories wtih regard to the grade level of pupils under their supervision, and the size of the community served, as follows:

Category	School Grade Levels of Pupils Under Supervision	Size of Community (Population)	Number Responding
1	Elementary	Under 5,000	3
2	Secondary	Under 5,000	5
3	Elementary and Secondary	Under 5,000	3
4	Elementary	5,000-15,000	13
5	Secondary	5,000-15,000	25
6	Elementary and Secondary	5,000-15,000	13
7	Elementary	15,000-25,000	8
8	Secondary	15,000-25,000	11
9	Elementary and Secondary	15,000-25,000	11
10	Elementary	25,000-50,000	13
11	Secondary	25,000-50,000	14
12	Elementary and Secondary	25,000-50,000	15
13	Elementary	50,000-100,000	7
14	Secondary	50,000-100,000	6
15	Elementary and Secondary	50,000-100,000	20
16	Elementary	Over 100,000	10
17	Secondary	Over 100,000	20
18	Elementary and Secondary	Over 100,000	20
		Total	217

Presentation of the Data

Total scores were computed in each category of public school physical education for the three criteria for rating: Frequency, Difficulty, and Importance. The total scores were transmuted into deciles for the purpose of facilitating the comparison of the three criteria.

In terms of time spent on the various phases of the job, mean percentages were computed with regard to the approximate percentage of time spent in

TABLE 1

Mean Percentage of Time Spent in the Major Units of the Duties and Mean Percentage of Time Recommended in the Major Units of the Duties (*)

Major Units of Duties	Under 5,000			5,000-15,000			15,000-25,000			25,000-50,000			50,000-100,000			Over 100,000		
	E	S	C	E	S	C	E	S	C	E	S	C	E	S	C	E	S	C
I. Administrative	10	9	8	5	6	6	9	8	7	7	12	12	7	12	17	19	21	20
*	5	8	2	3	8	9	9	15	5	12	18	13	9	11	23	13	21	17
II. Plant, Facilities, Equipment, Supplies	6	6	3	4	5	4	5	5	4	5	5	7	6	4	5	8	7	6
*	4	8	7	3	6	5	5	4	5	6	6	8	10	3	5	7	5	6
III. Instructional (Non-Supervisory)	38	55	48	42	59	50	41	59	51	14	43	31	20	43	19	4	39	4
*	39	57	25	41	54	44	27	49	49	10	37	16	18	42	14	9	30	5
IV. Supervisory (Supervision-Teaching)	22	1	18	23	5	21	30	4	12	55	10	27	45	21	35	54	10	50
*	30	1	22	29	5	18	45	6	12	48	9	41	40	25	33	54	16	48
V. Community Activities	2	3	2	4	2	2	3	4	2	5	3	6	6	3	6	3	3	4
*	3	2	4	5	4	4	3	5	3	6	7	6	5	3	6	4	5	6
VI. Co-Curricular or Extra-Class	15	10	8	13	10	7	5	10	10	3	12	8	4	10	4	3	6	4
*	10	8	24	12	10	7	5	9	9	3	9	7	6	7	3	2	7	4
VII. Special Services and Activities	2	5	6	2	4	3	4	3	2	4	4	4	6	3	5	2	4	4
*	2	4	5	2	4	4	3	6	3	7	4	6	6	3	5	2	4	4
VIII. Interscholastic Athletics	3	9	2	4	7	5	1	4	9	1	7	1	0	0	1	0	5	2
*	3	9	3	3	5	4	1	3	9	0	5	0	0	0	2	0	5	3
IX. Personal Professional and Professional Contributions	2	2	5	3	2	2	2	3	3	6	4	4	6	4	8	7	5	6
*	4	3	8	2	4	5	2	4	5	8	5	3	6	6	9	7	7	7
Hours Per Week Spent on Job	48	42	50	43	47	42	41	46	43	43	42	44	38	39	44	42	45	44

the major units of the duties. In terms of time *recommended* for the various phases of the job, mean percentages were computed with regard to the approximate percentage of time *recommended* in the major units of the duties.

Table 1 shows the mean percentage of time spent in the major units of the duties and the mean percentage of time *recommended* in the major units of the duties. For example, it may be observed that elementary school supervisors in the smallest communities spend a mean of less than one-fourth of their time in supervisory work, and *recommend* that 30 per cent of their time be spent on such duties; supervisors of elementary and secondary schools spend a mean of 48 per cent of their time in non-supervisory instructional work, and *recommend* that such duties occupy only 25 per cent of their time.

Summary and Conclusions

Of the 157 duties, there were certain of them which rated high in all of the criteria, that is, Frequency (occasionally to frequently), Difficulty (some to considerable), and Importance (considerable to extreme). Other duties were shown to be considered as *Important* or *Difficult*, but for some reason infrequently performed. In such cases, the factors which were stated to affect performance were indicated.

From the data procured, the following conclusions may be drawn:

1. The final list of duties is descriptive of all phases of the woman physical education supervisor's job.

2. The term "supervisor" in this field at the present time must be regarded as lacking in precise meaning; in itself, the title does not indicate the type or extent of actual supervisory duties performed. In fact, as carried by nearly one in four (97 of 407) of the women so designated, the title is a misnomer; the women themselves stated that they do *no* supervisory work.

3. The study indicates the need for help to supervisors in their training for effective personnel relations (the duty "Hold conferences with teachers to discuss problems"—rated high in *frequency*, *difficulty*, and *importance*) and for training for abilities needed in leadership in curriculum evaluation and development ("Work with curriculum consultants in analysis and development of curriculum" and "Prepare descriptions of educational philosophy and objectives with teachers" were rated either *difficult*, or *important* or both).

4. "Supervising intramural program" and "Supervision of recreation program" seem to be basic to the job of supervisors, except those in the smallest communities (under 5,000), where there is evidently not time in the supervisor's day for these activities, and in the largest communities (over 100,000), where such activities are probably supervised by the respondents only through subsidiary personnel.

5. Interscholastic athletics for girls received low decile ratings for *frequency* in community populations of 25,000 and above. They are frowned upon by the stated school policy of many such communities. Since these communities have the greatest amount of well defined supervision, this trend

might be indicative to smaller-sized communities where such athletics are a part of the program.

6. Of the nine factors possibly affecting the supervisors' performance, the three most often listed were, in order: *Administrative policy; Time element; Education and training.*

Interpretation of the implications of the effects of these factors upon the entire list of duties offers material of much interest; to include it in detail is not within the scope of this article. Comments concerning some of the factors are basic to some of the conclusions.

7. The woman supervisor spends a mean of from 38 hours weekly (in elementary schools in communities of 50,000 to 100,000 population) to 50 hours weekly (elementary and secondary school supervisors in communities under 5,000) on the job.

8. A summary is given (Table 1) not only of the mean percentages of time spent on the major units of duties by all supervisors responding, but of the mean percentages of time *recommended* to be spent in each category. Supervisors in cities with populations below 25,000 spend a greater percentage of their time in instructional (non-supervisory) duties than on supervisory (supervision-teaching) duties. Only in schools in cities of 25,000 and over does the woman physical education supervisor spend as much as half of her total time in supervisory (supervision-teaching) duties, and only in these communities does she feel that the time so spent is adequate. Only in cities where the supervisor is not carrying a teaching load (the larger communities) are the duties of a supervisory nature receiving the time which the supervisor feels they should have.

9. The data obtained in this study have been extensive and could have many uses. The final list of duties, for instance, might be used for some of the following purposes:

a. A checklist for women physical educators interested in supervision as a career.

b. A guide to be used at both graduate and undergraduate levels, by those responsible for the preparation and training of women physical education supervisors.

c. A checklist for women physical education supervisors to broaden their comprehension of the possibilities for better job performance.

d. An aid to state departments of education in the development and evaluation of job standards of women physical education supervisors.

REFERENCES

1. CHAPPELL, GERALD G., *Training Supervisors,* Calif. Inst. of Technology Industrial Relations Bulletin No. 10, The Ward Ritchie Press, Los Angeles, Calif., 1943.
2. CHARTERS, W. W., *Curriculum Construction,* New York: The Macmillan Co., 1923.
3. ———, *How To Sell at Retail,* Boston: The Houghton Mifflin Co., 1929.
4. ——— and D. A. HINDMAN, *The Duties of Ohio Public-Health Commissioners,* Bureau of Educational Research Monograph No. 17, Ohio State University, Columbus, Ohio, 1933.

5. ———, and ISADORE B. WHITLEY, *Analysis of Secretarial Duties and Traits*, Baltimore, Md.: Williams and Wilkins Co., 1924.
6. DOUGLASS, R. N., *The Duties of Department Heads, Acting Heads, and Chairmen in Senior High Schools in California*, Master's thesis, University of Southern California, 1928.
7. FALLS, J. D., *Job Analysis of State High School Supervisors in the United States*, Contributions to Education No. 25, George Peabody College for Teachers, Nashville, Tenn., 1926.
8. FITCH, H. N., *An Analysis of the Supervisory Activities and Techniques of the Elementary School Training Supervisor in State Normal Schools and Teachers Colleges*, Contributions to Education, No. 476, Columbia University Teachers College, New York, 1931.
9. GOODENOUGH, FLORENCE L., *Mental Testing*, New York: Rinehart and Roberts, Inc., 1949.
10. HINDMAN, DARWIN A., An Analysis of the Activities of Physical Education Teachers in High Schools, *Research Quarterly* **8**: 2: 117-131, May 1937.
11. HUMPHREY, J. H., *A Job Analysis of Selected Public School Physical Education Directors*, Master's thesis, Boston University, 1949.
12. KIBBE, DELHIA, An Analysis of Activities of Rural School Supervisors, *Elementary School Jl.*, **28**: 5: 346-352, Jan. 1928.
13. MAYBURY, SALLY B., *A Job Analysis Technique Applied to Secretarial and Stenographic Positions Employing Persons Trained in Post High School Secretarial Curriculums to Reveal Curriculum Guidance Implications*, Doctoral dissertation, Boston University, 1942.
14. MERRICK, ROSWELL D., *A Job Analysis of Selected Health Educators in Colleges and Universities*, Master's thesis, Boston University, 1953.
15. MEYERS, DORICE, *The Administration and Supervisory Duties of Heads of Departments of Physical Education for High School Girls*, Master's thesis, University of Southern California, 1928.
16. MONROE, W. S., *The Duties of Men Engaged as Physical Education Directors or Athletic Coaches in High Schools*, Bureau of Educational Research Bulletin No. 30, University of Illinois, Urbana, 1926.
17. POTTER, THELMA MAUDE, *An Analysis of the Work of General Employees*, Master's thesis, Columbia University Teachers College, New York, 1943.
18. STRONG, EDWARD K., and RICHARD UHRBROCK, *Job Analysis and the Curriculum*, Baltimore, Md.: Williams and Wilkins Co., 1923.
19. VALENTINE, P. F., A Job Analysis of Elementary Supervisors, *Jl. of Educational Methods* **7**: 5, March 1926.
20. VEYSEY, VICTOR V., *Selecting, Training, and Rating Supervisors*, California Institute of Technology Industrial Relations Bulletin No. 7, The Ward Ritchie Press, Los Angeles, Calif., 1943.
21. ———, *Using Descriptions of Supervisory Jobs*, California Institute of Technology Industrial Relations Bulletin No. 7, The Ward Ritchie Press, Los Angeles, Calif., 1943.

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Effects of Systematic, Heavy Resistive Exercise on Range of Joint Movement in Young Male Adults

BENJAMIN H. MASSEY AND NORMAN L. CHAUDET
University of Maryland
College Park, Maryland

Abstract

A study was conducted on the effects of continual heavy, resistive exercise on the range of movement in certain selected joints of young male adults. An experimental group (n = 13) trained with weights for approximately six months during which time a control group (n = 13) participated in general physical education activities. Weight training did not have an appreciable effect upon range of joint movement throughout the body. A significant decrease did take place in the ability of the experimental group to move the extended arms, from a position at the side of the body, backward in the antero-posterior plane.

REPETITION OF heavy resistive exercises, as is the case in certain occupations and in weight training, causes the muscles to grow stronger and to hypertrophy. This muscular development, especially if it is excessive, is generally believed to be accompanied by a condition termed "muscle-boundness." The exact nature of this phenomenon is unknown, but traditionally it is thought to be characterized by slow, awkward movement and an inability to perform certain refined motor skills well.

Only within the past few years have researchers become interested in obtaining objective evidence regarding the nature of this phenomenon, especially as it relates to weight training. Assuming that "muscle-boundness" is due primarily to a reduction in speed of muscle movement, Capen 1950 (2), Chui 1950 (3), Brodt 1950 (1), Zorbas and Karpovich 1951 (13), and Wilkin 1952 (11) studied the effects of weight training on the speed and efficiency of muscle action as indicated by one or more tests of agility, power, and/or speed of rotating arm movement.

None of these studies indicated that weight training reduced the speed of muscle contraction. Actually, weight training tended to increase it. Masely, Hairabedian, and Donaldson 1953 (9) investigated the effects of weight training on both speed of rotatory arm movement and muscular co-ordination. The latter was measured by the rapidity with which a foil could be moved between two or more electrical contacts in the form of copper discs. The findings, although not statistically significant, were favorable to weight training.

It is evident from these studies that weight training does not restrict bodily movement in terms of speed of muscular contraction. Therefore, this study was undertaken to investigate "muscle boundness" as it is related to sys-

tematic heavy exercise from another aspect; namely, reduction in range of joint movement. It was hypothesized that, although muscular development results in increased speed of contraction, it is still possible that rapid and relatively marked hypertrophy might, through increased muscular tonicity, fibrosis, or perhaps sheer bulkiness, restrict the range of joint movement. If this occurs, it could easily leave an impression of, or perhaps even cause, awkward movement. The purpose of this study was to investigate the effects of systematic, heavy resistive exercise, in the form of weight training, engaged in over a period of approximately six months, on the range of movement in certain selected joints of a group of young male adults.

Related Literature

Numerous studies have been conducted on range of joint movement and general bodily flexibility. Only two were found, however, which relate specifically to the present investigation. Wilson 1947 (12) studied the effects of one semester of weight training on the physical fitness of young male college students. Two groups were equated on the basis of a muscular endurance test. The experimental group ($n = 16$) exercised with weights three periods a week for approximately four months. The actual activity time in each period was about 30 minutes. The control group ($n = 8$) engaged in volleyball for an equivalent period of time. Among the fitness tests administered were three of Cureton's measures of flexibility: trunk extension, trunk flexion, and shoulder lift. Wilson found from comparing the pretraining and post-training measures that the mean flexibility of the weight trainees increased while that of the volleyball group decreased. These changes were not statistically significant. Counsilman 1955 (4), in an exploratory study, using Cureton's tests of flexibility, measured the flexibility of 18 competitive weight lifters, one of whom was "Mr. America" of 1952. The weight lifters were found to be considerably above average in flexibility, but Counsilman cautions that this does not mean that range of movement might not be limited in certain joints. He recommended that a systematic investigation be carried out.

Procedure

The study was conducted between September 30, 1952 and June 6, 1953. Initially, 81 male volunteer subjects from the University of Maryland's general physical education program were measured with respect to 16 variables. Seven of these measurements involved range of movement in certain selected joints and nine were control measures taken to indicate the effectiveness of the weight training program. The measurements taken were elbow extension, hip extension, hip flexion with the knee extended straight, hip flexion with the knee bent, knee flexion, shoulder flexion, shoulder extension, height, weight, back lift, leg lift, grip strength, biceps girth, chest girth, thigh girth, and calf girth. These data were used for establishing the reliability of the techniques used, and constituted the pretraining tests for those persons who continued as subjects throughout the experimental phase of this investigation.

Subjects. The subjects were in sufficiently good health to participate in the

regular required physical education program. They ranged in age from 17 to 28 years, with a mean age of 19.4 years. Fifty of the subjects were members of weight-lifting classes, and 31 were from classes engaged in other types of activities such as tennis, touch football, wrestling, track, volleyball, etc.

Measurement Procedure. The subjects were measured at least twice and on different days. The days elapsing between tests ranged from consecutive days to 14, with a mode of two days. Subjects were requested to engage in a minimum of activity on the day of testing. Measurements were taken without warm-up. The sequence was as follows: height, weight, girths, joint movements, and strength. The girth and joint movement measurements consisted of two or more consecutive trials. The average of these trials was taken as the test score. Two or more strength measures also were taken durng one testing period, but the best performance was the strength score used in this investigation. All variables which could be measured bilaterally were measured only on the right side.

Height was measured with the subject's shoes removed. A wall stadiometer was used and the measurement taken to a tenth of an inch. Weight, with the subject's clothes removed, was recorded with balance scales to the nearest pound. Girths were measured with a linen tape to the nearest millimeter. Biceps girth, thigh girth, and calf girth were recorded with the muscles contracted; chest girth was recorded with the chest fully expanded and the thoracic area muscles contracted.

Range of joint movement was measured to the nearest degree using a flexometer modeled after the type employed by Taylor (10) and Leighton (8). All measurements except elbow extension were recorded with the subject in the lying position (see Figure I). Exploratory work indicated that this was necessary in order to prevent extrinsic body movement. When the two tests for a given variable demonstrated a marked discrepancy, a third test was administered on another day. A discrepancy of five degrees or more was the criterion which determined the need for a third test. This criterion was arbitrarily selected after reviewing the data. The number of items upon which the subjects were retested varied, with no one subject having to repeat all seven tests. The incidence of retests was 15 per cent of the total.

Back and leg strength were measured to the nearest five pounds with a Medart-Chatillon back and leg dynamometer. A belt was not used. A spring hand dynamometer was used to record grip squeeze to the nearest pound.

All measurements were taken by the two investigators, with one recording all joint movements, and the other recording over 80 per cent of the strength and girth measurements.

Experimental Procedure. The experimental phase of the study was carried through on 26 of the original group of 81 subjects. Thirteen of the 50 members of the weight-lifting class volunteered to be retested at the end of the first semester of training, and to continue weight training throughout the second semester. Only individuals who were enthusiastic about training, who in-

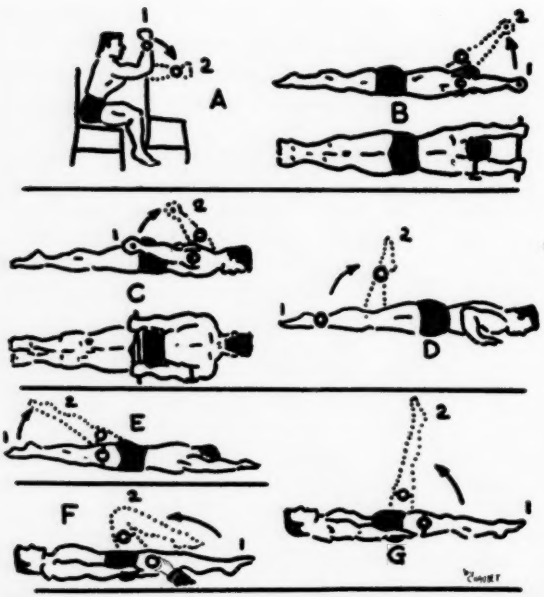

FIGURE I. A. Elbow Extension; B. Shoulder Flexion; C. Shoulder Extension; D. Knee Flexion; E. Hip Extension; F. Hip Flexion—Knee Bent; G. Hip Flexion—Knee Straight. Elbow Extension, Hip Flexion—Knee Bent and Hip Flexion—Knee Straight were recorded with only the right limb being moved. The remaining measurements were recorded on the right side but with both limbs being moved simultaneously.

curred no injury which prohibited them from exercising regularly, and who attended class regularly were invited to participate. The number of class absences for this group over the two-semester period ranged from zero to nine, with a mean of 2.8 periods. Two routines of ten exercises involving all major body parts were employed each semester. Emphasis was placed upon upper body development and upon increasing the exercise load as rapidly as possible. The initial weight for an exercise was set at a load which permitted from six to eight repetitions. As soon as the trainee could perform ten repetitions, the load was increased. Only one member of this group stated that he had previous experience with weight training. The weight training program was directed and supervised by the investigators.

The control group consisted of 13 of the original 31 subjects from other classes in the general physical education curriculum. This reduction in number resulted primarily from injuries and withdrawal from school. Two subjects of extreme body size, 228 and 233 pounds respectively, were not invited for retests. These two subjects were dropped because there were no subjects of comparable size among the trainees, and because it is thought by some that fat impedes bodily flexibility (7).

Both the experimental and control groups were measured under similar conditions before the start of training, after a semester of activity, and at the end of the training period. The only differences in the treatment of the two groups were: (1) The experimental group was measured before the control group. This was done to insure the procurement of adequate measurements on the entire group and forestall the loss of subjects. (2) Eleven of the 13 trainees inadvertently had one practice session with the back and leg lift before the experimental measurements were taken. This may have served to lessen the apparent improvement of the trainees in strength during the training period as opposed to that of the controls.

The measurement procedure was the same as that previously outlined. Representative scores for the pretraining, mid-training, and post-training tests were obtained by averaging the scores for the two tests. The representative scores for individuals having three tests on certain joint movements were obtained by averaging the two closest of the three tests. Strength measures were not averaged, but the higher of the two scores was used. In the few instances when second tests were not recorded, the single test score was used.

Statistical Treatment of the Data

1. *Frequency Distributions.* The frequency distributions of the variables were plotted to give some idea as to the adequacy of the data for statistical treatment. Analysis was made by inspection only.

2. *Reliability.* Reliability of the data for all variables was determined on a test retest basis using the two pretraining tests. In addition, for the range of joint movement, reliability of the variables was determined using the two closest scores of tests one, two, or three. The coefficient of correlation (raw score formula) and the t ratio (formula for correlated data) were computed to show consistency within the group and significance of mean change.

3. *Equivalence of Experimental and Control Groups.* The degree to which the two groups were equated was estimated in terms of difference in means and variances. The t ratio (independent group formula) and the F ratio were employed.

4. *Mean Difference Between Pre- and Post-Training Tests.* The significance of the mean difference between the pretraining and post-training measures within each group, and the significance of the mean difference in the changes between the two groups were evaluated in terms of the t ratio and F ratio. The latter was computed only for variables demonstrating a t ratio significant at the 5-per-cent level or better. It provided a check on the extent to which the t ratio represented a difference in means (5).

Findings

Tables 1 through 4 show the results of the study.

Frequency Distributions. The distributions for all variables, except leg lift and hip extension, approximated the normal, bell-shaped curve. The distribution of these two variables had a distinct positive skew.

Reliability (*Table 1*). The reliability of the data, except for back lift, leg lift, and chest girth, was acceptable. These three variables appeared to be affected by learning. The taking of a third range of movement test in instances when a marked discrepancy occurred between the first and second tests distinctly improved the reliability of the data.

TABLE 1

Reliability of Data as Indicated by Coefficients of Correlation and t-ratios for Pre-Training Tests

Item	Coefficients of Correlation: Tests 1 & 2 r_{11}	n	Tests[1] 1, 2, or 3 r_{11}	n	Significance of Mean Difference: Means Test 1	Test 2	t-ratio[2]	n	Tests 1, 2 & 3 t-ratio	n
Height (in.)	.998	78	—	—	70.1	70.2	0.75	78	—	—
Weight (lb.)	.998	78	—	—	163.0	163.2	0.96	78	—	—
Strength (lb.)										
Leg Lift	.766	81	—	—	425	469	5.05[3]	81	—	—
Back Lift	.732	80	—	—	287	301	2.94[3]	80	—	—
Grip Squeeze	.918	81	—	—	113	114	1.35	81	—	—
Girth (cm.)										
Biceps	.983	81	—	—	32.6	32.7	0.60	81	—	—
Chest	.977	81	—	—	100.0	100.7	4.42[3]	81	—	—
Thigh	.976	81	—	—	56.9	57.0	0.37	81	—	—
Calf	.971	81	—	—	36.6	36.7	1.22	81	—	—
Range of Movement										
Elbow Extension	.881	81	.937	81	93.3	93.6	0.73	81	1.09	81
Hip Extension	.880	81	.945	81	21.9	22.4	1.15	81	0.40	81
Hip Flexion, Knee Straight	.952	81	.969	81	87.7	87.5	0.61	81	1.83	81
Hip Flexion, Knee Bent	.780	81	.949	81	119.8	121.0	1.85	81	1.03	81
Knee Flexion	.942	81	.958	81	126.02	125.99	0.13	81	0.74	81
Shoulder Flexion	.959	81	.981	81	25.2	25.0	0.75	81	0.82	81
Shoulder Extension	.873	80	.972	80	54.3	54.2	0.23	80	0.73	80

[1]Correlation coefficients based on data using two closest scores for individuals requiring a third test.
[2]Levels of confidence with 80 degrees of freedom: 5%–1.99; 1%–2.64.
[3]Significant at the 1% level of confidence.

Equivalence of Groups (*Table 2*). The experimental and control groups were reasonably well equated. A statistically significant difference between group variances for some variables was to be expected.

Mean Difference Between Pre- and Post-Training Tests (*Tables 3 and 4*). The weight-training group showed statistically significant gains during the experimental period in seven of the nine control variables; that is, measures recorded to demonstrate the effectiveness of the weight-training program. The control group, with respect to the same variables, increased significantly in four of the nine and decreased at the one-per-cent level of confidence in grip strength.

TABLE 2

Significance of Differences Between Means and Variances for the Weight-Training and Non-Weight-Training Groups on Pre-Training Test Scores

	Weight Trainees		Controls			
Variable	n	Mean	n	Mean	t-ratio	F-ratio
Height (in.)	13	70.4	13	70.0	0.46	1.07
Weight (lb.)	13	159	13	162	0.40	2.04
Strength (lb.)						
Leg Lift	13	531	13	519	0.25	1.38
Back Lift	13	313	13	318	0.30	2.33
Grip Squeeze	13	112	13	116	0.82	1.63
Girth (cm.)						
Biceps	13	32.7	13	32.6	0.11	1.28
Chest	13	99.2	13	101.7	1.13	1.89
Thigh	13	56.3	13	55.8	0.29	1.56
Calf	13	36.1	13	36.5	0.43	1.32
Range of Movement (deg.)						
Elbow Extension	13	92.5	13	94.5	0.75	3.98[1]
Hip Extension	13	23.5	13	25.0	0.44	5.64[2]
Hip Flexion, Knee Straight	13	88.7	13	87.5	0.25	2.21
Hip Flexion, Knee Bent	13	118.6	13	123.2	1.43	2.48
Knee Flexion	13	124.8	13	129.1	1.56	2.44
Shoulder Flexion	13	24.0	12[3]	23.5	0.16	1.48
Shoulder Extension	13	55.2	12[3]	53.0	0.45	1.14

Levels of Confidence:
t-ratio with 24 degrees of freedom: 5%–2.06; 1%–2.80.
F-ratio with 12 and 12 degrees of freedom: 10%—2.69; 2%—4.16.
[1]Significant at the 10% level of confidence.
[2]Significant at the 2% level of confidence.
[3]Reduction of n to 12 caused by inability to measure one subject owing to extreme range of movement.

The trainees decreased in five of the seven joint movement variables. Four of the mean decreases were statistically significant. The controls decreased in six of the seven variables and three were statistically significant.

The fact that these changes were in the same direction and about equally great for most of the variables indicates the presence of some extraneous factor. In a longitudinal study one can never be sure that systematic differences in procedure are eliminated. On the other hand, girth measures are subject to the influence of growth, while the flexibility measures could have been affected by changes in climatic conditions, maturation (6), or reduced physical activity during the school months.

Differences Between the Mean Changes of the Groups. Only grip strength, biceps girth, and shoulder extension had mean changes which differed significantly between groups. The weight-training group increased 5.8 pounds in grip strength and 1.9 centimeters in biceps girth, while the control group decreased in grip strength on an average of 5.7 pounds and gained in biceps

TABLE 3

Mean Values for Pre-Training, Mid-Term, and Post-Training Measurements

Variable	Weight Trainees							Controls						
	n	x_I	σ^2_I	x_{II}	σ^2_{II}	x_{III}	σ^2_{III}	n	x_I	σ^2_I	x_{II}	σ^2_{II}	x_{III}	σ^2_{III}
Height (in.)	13	70.4	6.3	70.4	5.7	70.5	6.1	13	70.0	5.9	70.2	5.9	70.1	6.0
Weight (lb.)	13	159	490	165	633	165	590	13	162	240	163	184	163	217
Strength (lb.)														
Leg Lift	13	531	13855	535	20764	605	23698	13	519	19151	518	24415	611	18045
Back Lift	13	313	1507	337	2977	343	1618	13	318	3510	345	5944	365	7694
Grip Squeeze	13	112	147	114	164	118	190	13	116	90	107	102	110	73
Girth (cm.)														
Biceps	13	32.61	5.2	34.2	5.9	34.5	5.6	13	32.6	4.0	33.1	4.3	33.1	5.2
Chest	13	99.2	40.2	101.0	46.0	101.8	39.2	13	101.7	21.2	103.0	21.8	103.2	19.7
Thigh	13	56.3	19.3	56.1	19.0	56.5	17.6	13	55.8	12.3	56.3	10.5	55.7	12.7
Calf	13	36.1	4.8	36.8	5.0	37.0	5.1	13	36.5	6.3	37.1	4.7	37.3	5.4
Range of Movement (deg.)														
Elbow Extension	13	92.5	18.8	89.7	22.6	90.1	19.9	13	94.5	74.6	89.2	33.3	90.8	34.0
Hip Extension	13	23.5	21.4	20.8	30.8	19.2	19.5	13	25.0	120.8	20.0	78.5	21.8	109.5
Hip-Flexion, Knee Straight	13	88.7	186.6	89.0	133.8	88.1	59.2	13	87.5	84.2	84.3	59.2	82.8	85.3
Hip Flexion, Knee Bent	13	118.6	96.8	120.9	58.4	120.1	58.1	13	123.2	39.0	123.2	33.0	121.4	26.9
Knee Flexion	13	124.8	70.8	125.6	80.2	125.7	78.1	13	129.1	29.1	128.0	32.2	127.7	42.4
Shoulder Flexion	13	24.0	46.7	23.3	53.9	22.3	39.6	12	23.5	69.2	23.8	85.8	24.1	123.7
Shoulder Extension	13	55.2	165.0	44.5	118.2	47.4	59.2	12	53.0	144.4	48.4	136.6	52.8	104.2

TABLE 4

Significance of the Differences Between the Mean Changes for the Weight-Training and Control Groups

Variable	Weight Trainees			Controls			Difference Between Mean Changes	
	n	Mean Change	t-ratio	n	Mean Change	t-ratio	Difference	t-ratio
Height (in.)	13	.09	1.74	13	.11	1.37	.02	0.17
Weight (lb.)	13	6.1	3.60[1]	13	1.0	0.48	5.1	1.89
Strength (lb.)								
Leg Lift	13	73	3.24[1]	13	92	3.11[1]	18	0.50
Back Lift	13	31	2.86[2]	13	47	2.40[2]	16	0.72
Grip Squeeze	13	5.8	2.73[2]	13	−5.7	3.14[1]	11.5	4.12[1]
Girth (cm.)								
Biceps	13	1.9	7.18[1]	13	0.6	1.78	1.3	3.18[1]
Chest	13	2.6	4.16[1]	13	1.5	2.24[2]	1.1	1.18
Thigh	13	0.2	0.37	13	−0.1	0.22	0.3	0.42
Calf	13	0.8	4.81[2]	13	0.7	4.92[1]	0.1	0.34
Range of Movement (deg.)								
Elbow Extension	13	−2.5	2.84[2]	13	−3.8	3.72[1]	1.3	0.98
Hip Extension	13	−4.3	5.36[1]	13	−3.2	4.07[1]	1.2	1.03
Hip Flexion, Knee Straight	13	−0.6	0.24	13	−4.7	2.28[2]	4.1	1.25
Hip Flexion, Knee Bent	13	1.5	0.88	13	−1.8	1.67	3.3	1.66
Knee Flexion	13	0.9	1.45	13	−1.4	1.48	2.3	2.04
Shoulder Flexion	13	−1.7	2.30[2]	12	0.6	0.51	2.3	1.67
Shoulder Extension[3]	13	−7.8	3.81[1]	12	−0.2	0.09	7.7	2.76[2]

Negative sign indicates decrease during experimental period.
Confidence levels: t-ratio with 12 degrees of freedom: 5%–2.18; 1%–3.06.
t-ratio with 24 degrees of freedom: 5%–2.06; 1%–2.80.
[1]Significant at the 1% level of confidence.
[2]Significant at the 5% level of confidence.
[3]F-ratio computed for all variables having significant t-ratios. Shoulder Extension for Weight Trainees demonstrated significant difference at 10% level of confidence.

girth 0.6 centimeters. Group differences were 11.5 pounds and 1.3 centimeters respectively. The failure of the back and leg strength measures to show a difference was probably due to the low reliability of these measures. The weight-training program apparently did not affect over-all body development to any marked degree, but did affect upper body development, especially in the arms. The difference in mean change in shoulder extension movement amounted to a 7.6 degree difference, with the weight-training group decreasing 7.8 degrees and the control group 0.2 degrees. Table 3 reveals, however, that for both groups the decrease in this variable during the experimental period was not consistent. The difference between the pre-training and mid-training means was greater than the difference between the pre-training and post-training means. Some systematic influence apparently affected the measures. This, however, does not necessarily invalidate the measure, since the mean difference between the groups was statistically significant.

The decrease of 7.8 degrees for the trainees in shoulder extension is more meaningful when compared with the performance of the entire group of 80 cases.[1] Employing the second of the pretraining tests for norm purposes, it is found that a 7.8 degree change represents a z score of 0.72. The mean range of movement for the 80 cases was 54 degrees, which means that the 7.8 degree decrease is equivalent to a 14 per cent reduction in mobility.

Knee flexion was found to have a mean difference between groups which approached significance at the 5-per-cent level of confidence. The weight-training group had a mean increase of 0.9 degrees, and the control group a decrease of 1.4 degrees. The direction of change was consistent throughout the experiment (Table 3).

It is interesting to note that hip flexion and knee flexion, movements which receive emphasis in weight-training programs, tended to increase or show less decrement in the weight-training group as opposed to the controls. On the other hand, hip extension, shoulder flexion, and shoulder extension, movements which are not usually stressed by beginning weight trainees, all showed a greater decrease for the trainees than was true for the controls. If these findings represent an actual trend, it would appear that weight lifting increases range of movement in joints exercised while it may actually restrict movement in areas not exercised. This could result from imbalance in the development of the muscles surrounding or affecting the movement of a joint.

Summary and Conclusions

An investigation was undertaken to study the effects of systematic, heavy resistive exercise on the range of joint movement of young, male adults. Two groups, an experimental and control, n = 13 respectively, were employed. The experimental group trained with weights for six and a half months, while the control group participated in other kinds of physical activity. Measures in range of joint movement and certain other variables, selected as indicators of the effectiveness of the exercise program, were recorded prior to training, midway through the training period, and at the end of training.

The findings may be summarized as follows:

1. The weight-training program did not appear to affect over-all body development, but did cause marked increases in upper arm girth and grip strength.

2. Participation in systematic, heavy resistive exercise to the extent engaged in by the experimental group in this study does not result in an over-all reduction in range of movement of the joints throughout the body.

3. The capacity of the weight-training group to execute the movement of shoulder extension was significantly decreased as compared with the reduction in this movement occurring in the control group. This movement involves moving in the anteroposterior plane both arms simultaneously from a position alongside of the body to a point as far back as possible.

[1]The n is 80, since one subject was too flexible to be measured.

4. The increase in the knee flexion of the weight-training group as compared with the control group closely approached significance at the 5-per-cent level of confidence.

The fact that deep knee bend was an exercise routinely engaged in by the trainees, and shoulder extension was not, may be significant. If these findings can be attributed to the exercise program rather than to some extraneous influence, then it is feasible to surmise that heavy, resistive exercise effects either a reduction or increase in range of movement, depending upon the training routine and the manner in which the exercises are executed.

REFERENCES

1. Brodt, A. E., *Change in Physical Fitness Associated with Weight Lifting.* Unpublished Master's thesis, University of Illinois, Urbana, 1950, 114pp.
2. Capen, E. K., The Effect of Systematic Weight Training on Power, Strength, and Endurance, *Research Quarterly*, **21**: 83-93, May 1950.
3. Chui, E., The Effect of Systematic Weight Training on Athletic Power, *Research Quarterly*, **21**: 188-94, Oct. 1950.
4. Counsilman, J. E., Does Weight Training Belong in the Program? *Journal of Health–Physical Education–Recreation*, Jan. 1955, p. 17.
5. Edwards, A. L., *Statistical Analysis for Students in Psychology and Education.* pp. 295-99. New York: Rinehart and Co., 1946, 360pp.
6. Forbes, J. M., *Characteristics of Flexibility in Boys.* Unpublished doctoral dissertation, University of Oregon, Eugene, 1950, 150pp.
7. Karpovich, P. V., *Physiology of Muscular Activity.* p. 101, Philadelphia: W. B. Saunders Co., 1953, 340pp.
8. Leighton, J. R., A Simple, Objective and Reliable Measure of Flexibility, *Research Quarterly*, **13**: 205-16, May 1942.
9. Masely, J. W., A. Hairaredian, and D. N. Donaldson, Weight Training in Relation to Strength, Speed and Co-ordination, *Research Quarterly*, **24**: 308-15, Oct. 1953.
10. Taylor, L., *Studies in Flexibility.* Unpublished Master's thesis, Internatl. YMCA College, Springfield, Mass., June 1928.
11. Wilkin, B. M., The Effect of Weight Training on Speed of Movement, *Research Quarterly*, **23**: 361-9, Oct. 1952.
12. Wilson, A. L., *The Effect of Weight Training on the Physical Fitness of Young Men.* Unpublished Master's thesis, University of Illinois, Urbana, 1947, 114pp.
13. Zorbas, W. S., and P. V. Karpovich, The Effect of Weight Lifting Upon the Speed of Muscular Contraction, *Research Quarterly*, **22**: 145-8, May 1951.

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A Health and Safety Attitude Scale for the Seventh Grade[1]

CYRUS MAYSHARK
National Foundation for Infantile Paralysis
Portland, Maine

Abstract

This study presents the steps that were followed in organizing a seventh-grade health and safety attitude scale, in two statistically equivalent forms. The measurement technique employed was the situation-response item used successfully by psychology and sociology. The alternate forms, after extensive refinement, proved to be satisfactorily valid and reliable.

THE PURPOSE OF this study was to develop a scale to measure the attitudes of seventh-grade students toward several selected areas of health and safety.

An interested reader of research appearing in the literature will have little difficulty in finding a rather extensive list of health education knowledge tests. Bridges' study (3) contains a review of most of these. This is easily explained, of course, by the fact that more adequate tools are available to test knowledge. This has, quite naturally, resulted in a greater amount of research in the area of health education knowledge testing.

Despite this emphasis on knowledge, it is recognized that accurate evaluation of attitudes is of equal importance. If valid and reliable attitude scales were available at the various grade levels, health education would take great strides toward realizing its objectives.

The present scale is aimed at a single grade since those which claim to be effective for several grades sacrifice validity and reliability. This fact has been pointed out by Patty (10) and others. While the present author recognized that the time and efforts required to construct a scale for each or every other grade would be enormous, he did not wish to condone expediency to the detriment of good research.

The present scale was placed at the seventh-grade level because of the widespread belief among child development experts that this age, 11 to 13 years, is a vitally important stage in the development of attitudes.

Definition of Attitude

Health educators are interested in the formation of attitudes which find their expression in desirable health habits and practices. Hence the actions of the subject toward specific health objects become objective, measurable reflections of the attitudes he holds toward these objects. If, for example, one

[1]This study was made in partial fulfillment of the requirements for the degree of Doctor of Health and Safety in the School of Health, Physical Education, and Recreation, Indiana University, Bloomington, Indiana.

seventh-grade pupil last brushed his teeth two days ago, and another brushes his every morning after breakfast, it seems safe to assume that the attitudes the latter holds toward the care and cleanliness of his teeth are far more favorable than those of the former. The author, therefore, accepted the following definition by Bain (1). "An attitude is the relatively stable overt behavior of an individual which affects his status."

Related Research

The psychologist and sociologist made the early contributions to the field of attitude measurement. Techniques developed by Thurstone (15) and Likert (8) have stimulated much work, and the efforts of others such as Silance and Remers (13), Hunter (7), and Scheffler and Winslow (12) have resulted in some alteration in their original designs.

Attitude tests in the field of health education number exactly one, Byrd's *Health Attitude Scale* (4). Other scales, Franzen, Derryberry, and McCall (5), and Brewer and Schrammell (2), contain few items, if any, which measure attitude as such.

The attitude scales developed by Pace (9) and Rosander (11) represent interpretations of attitude similar to that adopted by the author.

Procedures

Attitudes have meaning only as they are expressed in terms of verbal and/or observable behavior. Using this as as frame of reference, the author selected, as his method of measurement, the situation-response, multiple-choice item technique used successfully by Pace (9) and Rosander (11).

After selecting the measurement technique, the next problem which arose with regard to curricular validity was to determine who could be considered an expert in health education at the seventh-grade level. There are many, of course, so the job became one of selection, and it was finally agreed that the authors of the several state-adopted health textbook series would meet the necessary requirements. In accepting this group, as large as any jury of experts would need to be, and allowing their writing to be the determiner of the basic health areas, it was felt that a more accurate and unprejudiced picture would be drawn than if an equally select group were contacted by letters.

The work of Foster (6) enabled the author to secure these data rather readily. During a careful analysis of the above-mentioned texts, Foster divided all subject matter into seven areas, and on a word-count basis established the percentage allocated by the authors to each. Table 1 shows the seven areas, as determined by Foster, and the percentage of importance apportioned to each for grades four, five and six, and the average for these three grades.

The average percentage for grades four, five, and six, as shown in Table 1, was selected as the basis upon which items for the present scale would be formulated. A more difficult problem to resolve was the selection of the attitudes to be investigated. What are the attitudes we expect of a seventh-grade

student? Much is written in the literature about the formation of correct health attitudes on all age levels, but very seldom is a specific attitude stated as being appropriate for a particular grade. One source, fortunately, proved to be the exception. After a careful analysis of 15 or more state courses of study for health and physical education, those which listed specific health attitudes as part of the teaching objectives for the fourth, fifth, and sixth grades were selected. Those attitudes which were given as objectives for the three grades were recorded, the final list totaling 116 with considerable duplication.

TABLE 1

Health Areas and Percentage of Importance of Each by Grade Level

Area	Grade			Average
	4	5	6	
Anatomy and Physiology	20.36	34.60	26.89	27.28
Personal Hygiene	25.80	20.40	14.10	20.10
Foods	10.98	12.08	16.21	13.09
Emergency Health Procedures	12.36	10.58	9.06	10.83
Environmental Hygiene	14.06	7.60	9.67	10.44
Diseases	9.08	6.34	12.61	9.34
Mental Hygiene	6.85	8.40	11.46	8.90

Each attitude was placed in the most appropriate of the seven established areas. No attempt was made at this point to eliminate those attitudes which overlapped or restated others. In addition, it was recognized that it would not be possible or desirable to translate all the stated attitudes into behavior situations relevant to the seventh-grade youngster.

Table 2 indicates the basis, in terms of Foster's area percentages and the total number of attitudes listed for each, upon which the situation-response items were formulated.

TABLE 2

Health Areas, Foster's Area Percentages, and Number of Attitudes Compiled for each

Area	Percentage	Attitudes
Anatomy and Physiology	27.28	29
Personal Hygiene	20.10	14
Foods	13.09	16
Emergency Health Procedures	10.83	16
Environmental Hygiene	10.44	14
Diseases	9.34	11
Mental Hygiene	8.90	16
Total	99.98	116

It should be pointed out that Foster's area percentages are based on a total word count of all health items, and that, therefore, the number of attitudes compiled need not necessarily conform to these percentages.

Each attitude in a given area was analyzed with a view to the type of behavior which could be manifested in the positive and negative expression of that attitude. Working toward an objective of 200 situations, the situations, each with five responses, were developed within one area at a time until the desired number, according to the percentage in Table 2, was realized.

All words used were checked against the Thorndike and Lorge (14) word list to ensure their appropriateness for the seventh-grade child.

The completed situation-response items were mimeographed and presented to the members, approximately 30, of two graduate classes in health education for the purpose of ordering the alternatives. This selected jury was asked to read each situation carefully, and then to assign a value of one to the least desirable option, two to the next least desirable, three to the most neutral, four to the more desirable, and five to the most desirable option. The term desirable was defined as that form of behavior which they felt, as teachers and advanced students, would be most beneficial for the seventh-grade youngster in terms of moral, social, mental, and physical health. Several situations were eliminated because of no consistent agreement among the judges in the ordering of the alternatives. A few more were discarded because of ambiguity. The terms that were considered satisfactory up to this point totaled 150.

Following the decision of the judging group, arbitrary weights ranging from one to five were assigned each of the alternatives for statistical and scoring purposes. In terms of these weights, a more favorable attitude toward the health objects in question was shown as the total score increased. The order of the five alternatives for each of the 150 situations then was determined by random.

The items within each of the seven areas were divided into two equal groups. One group of 75 items was designated as Preliminary Form A and the other as Preliminary Form B. (See sample, pages 58 and 59.)

The author personally administered the two preliminary forms to the seventh-grade students of a *random, stratified* sample selected from a list which included all the schools containing a seventh grade in southern Indiana. Southern Indiana was defined as that half of the state south of Route 40. The schools were stratified into three groups on the basis of total school population; 0-100, 101-500, 501 and up. Each of the three groups was proportionately represented in the selected sample. Form A was given to 167 boys and 167 girls while Form B was given to an alterate group of 177 boys and 166 girls.

Results

The reliability of Form A was found to be .932 and Form B, .935, both after correction by the Spearman-Brown formula.

A critical ratio for each of the 150 items was determined. In formulating the final forms it was decided, since high critical ratios were evidenced throughout, that two equivalent forms of 60 items each, with both maintain-

ing the original curricular validity requirements, were possible. The best 120 items were selected and divided into two equivalent forms, as determined by their respective critical ratios. These in turn were administered to another *random, stratified* sample. Form A was given to 152 boys and 168 girls, while Form B was given to 161 boys and 156 girls. Again, both forms were taken by completely independent groups. This fact ruled out the determination of the inter-form correlation, a statistic that has since been determined by the author.

Table 3 indicates the statistical data for final forms A and B. With a possible five points for each item, 300 would indicate the most favorable attitude toward all health and safety objects in question.

TABLE 3

Statistical Data for Final Forms A and B

Statistic	Form A			Form B		
	Boys	Girls	Total	Boys	Girls	Total
Number	152	168	320	161	156	317
Range	146-283	129-288	129-288	147-288	159-291	147-291
Mean	225.91	244.05	235-43	232.22	248.95	240.45
Median	227	251	242	234	252	245
Standard Deviation	32.96	33.10	34.25	31.53	26.72	30.43
Reliability						
Pearson r (odd-even)	.891	.880	.887	.865	.851	.869
Spearman-Brown (corr.)	.943	.936	.940	.928	.920	.930

DIFFERENCE OF RESPONSE BETWEEN SEXES

It is shown in Table 3 that both forms gave rather different results for girls than for boys. Further analysis indicated a statistically significant difference between their responses. Table 4 summarizes this point.

Girls score consistently higher than boys on both A and B forms. The critical ratios for the difference between the means and medians of girls and boys are significant at well beyond the .01-per-cent level.

TABLE 4

Statistical Summary of the Difference Between Girls and Boys on Final Forms A and B

Form	Statistic	Girls	Boys	Difference	Critical ratio
A	Mean	244.048	225.914	18.134	4.889
A	Median	251	227	24	5.177
B	Mean	248.949	232.217	16.732	5.087
B	Median	252	234	18	4.378

EQUIVALENCE OF FORMS A AND B

The procedures necessary to realize equivalence between Forms A and B were carefully followed throughout. Those items which have already been discussed include the following. First, a table of specifications was drawn up

after careful analysis of Foster's study and allocation of selected attitudes to selected areas. Second, the number of items formulated conformed, as nearly as possible, to the table of specifications. Third, in both the preliminary and final scales, the situation-response items from the same area were placed in the same relative position. Fourth, the items in both final forms were equated in terms of item difficulty.

Since this difference between boys and girls was significant, the statistical equivalence of the two forms was determined by comparing the boys on Form A with the boys on Form B, and the girls on Form A with the girls on Form B. The statistical indications of equivalence between the two forms are summarized in Table 5.

TABLE 5

Statistical Summary of the Equivalence Between Final Forms A and B

Statistic	Girls		Boys	
	Difference	Critical ratio	Difference	Critical ratio
Mean	4.901	1.47	6.303	1.72
Median	1	.24	7	1.53
Standard Deviation	6.373	2.70	1.433	.55

These results, a significant difference between girls and boys, and no significant difference between Forms A and B, indicated that it would be more appropriate to establish norms for boys and girls rather than for Forms A and B.

Conclusions

The conclusions to be drawn from the study are as follows:

1. Final Forms A and B are valid measures of the health and safety attitudes of seventh-grade youngsters.
2. The reliabilities of Final Forms A and B are sufficiently high to meet the requirements of good test construction.
3. Administration is objective and economical of time.
4. There is a statistically significant difference between the health attitudes of seventh-grade girls and boys.
5. Final Forms A and B are statistically equivalent.

REFERENCES

1. Bain, Read, An Attitude on Attitude Research, *American Journal of Sociolgy*, **33**: 940-957, May 1928.
2. Brewer, John W., and H. C. Schrammel, *Health Knowledge and Attitude Scale*, Bureau of Educational Measurements, Kansas State Teachers College, Emporia, 1935.
3. Bridges, Frank A., *A Valid Health Knowledge Test for College Freshmen*, doctoral dissertation, Indiana University, Bloomington, 1952, typed, 149 pp.
4. Byrd, Oliver E., *Health Attitude Scale*, Stanford University Press, Stanford University, Calif., 1940.

5. FRANZEN, RAYMOND, MAYHEW DERRYBERRY, and W. A. MCCALL, *Health Awareness Test*, Bureau of Publications, Teachers College, Columbia University, New York, 1937.
6. FOSTER, ROY A., *An Analysis of the Types and Quantity of Health Information in Selected Health Education Textbooks for Grades One Through Six*, doctoral dissertation, Indiana University, Bloomington, Indiana, 1952, typed, 404 pp.
7. HUNTER, E. C., Attitudes of College Freshmen, 1934-1949, *Journal of Psychology*, **31**: 281-296, Jan. 1951.
8. LIKERT, R., A Technique for the Measurement of Attitudes, *Archives of Psychology*, No. 140, 1932.
9. PACE, ROBERT C., A Situations Test To Measure Social-Political-Economic Attitudes, *Journal of Social Psychology*, **10**: 331-344, Aug. 1939.
10. PATTY, W. W., Blanket Health Education Tests Unsatisfactory, *Journal of School Health*, **20**: 258-260, Nov. 1950.
11. ROSANDER, A. C., An Attitude Scale Based Upon Behavior Situations, *Journal of Social Psychology*, **8**: 3-15, Feb. 1937.
12. SCHEFFLER, I., and N. WINSLOW, Group Position and Attitude toward Authority, *Journal of Social Psychology*, **32**: 177-190, Nov. 1950.
13. SILANCE, E. B., and H. H. REMMERS, An Experimental Generalized Master Scale: A Scale to Measure Attitude Toward Any School Subject, *Studies in Higher Education*, Purdue University, Lafayette, **35**: 84-87, Nov. 1934.
14. THORNDIKE, EDWARD E., and IRVING LORGE, *The Teacher's Word Book of 30,000 Words*, Bureau of Publications, Teachers College, Columbia University, New York, 1944, 274 pp.
15. THURSTONE, L. L., and E. J. CHAVE, *The Measurement of Attitude*, University of Chicago Press, Chicago, 1929, 96 pp.

ATTITUDE SCALE

Both Forms A and B contain 60 situation-response, multiple-choice items. Included here are the first five of each.

Form A

1. Your younger sister asks you to take her to the movies on a Saturday afternoon. You would:
   1. take her, but not enjoy it.
   2. refuse to take her.
   3. be happy to take her.
   4. tell her you were meeting a friend, even if you weren't.
   5. tell her she is too young for the movies.
2. It is reported that the dairy from which your parents buy milk is producing poor milk. You would:
   1. ask your parents to visit the dairy.
   2. stop drinking milk.
   3. continue to drink that company's milk.
   4. ask your friends about it.
   5. ask your parents to change dairies.
3. The janitor does a poor job of cleaning the school washrooms and toilets. You would:
   1. do little to help keep them clean.
   2. join some friends and speak to the janitor.
   3. not use them unless you absolutely had to.
   4. join some friends and speak to your teacher.
   5. make them dirtier in hopes something will be done.

4. You own only one pair of school shoes and these are continually becoming scuffed and dulled. You would:
   1. forget to clean them.
   2. clean them yourself once a day.
   3. clean them yourself once a week.
   4. let them wear out and then ask for another pair.
   5. ask your father to clean them when he does his own.
5. Several younger children have been hurt on and around the playground swings. You would:
   1. ask them to leave while you are playing there.
   2. swing yourself and watch them at the same time.
   3. let them look out for themselves.
   4. not swing, but watch the younger children.
   5. leave the swings when the younger children are there.

Form B

1. A school basketball game and a dance fall on the day that a family reunion has been planned in a town 50 miles away. You would:
   1. strongly argue in favor of the basketball game.
   2. ask your friends what you should do.
   3. attend the reunion.
   4. decide with your parents what you should do.
   5. refuse to go to the reunion.
2. The men responsible for collecting garbage fail to appear in your neighborhood for several days. You would:
   1. wrap it well and wait for the men to come.
   2. burn it every day and find out when the men will collect it.
   3. burn it when you see flies being attracted.
   4. burn it when it starts to smell badly.
   5. burn it every day.
3. You observe a classmate leave his gum in the water fountain. You would:
   1. leave your gum there also.
   2. get a drink there if you wanted one.
   3. remove it yourself if, when asked, your classmate refused.
   4. get a drink at another fountain.
   5. ask your classmate to remove it.
4. You come home after playing and track some dirt and leaves across the living room rug. You would:
   1. pick up the leaves and hope it will go unnoticed.
   2. try to blame someone else if you were not actually seen.
   3. clean up the worst of it.
   4. thoroughly clean it up without being asked.
   5. ask your mother to clean it up.
5. Your father drives you to school on his way to work. If you were both late one morning, you would:
   1. tell him to be careful and forget the time.
   2. let him drive as he wished.
   3. ask him to drive faster all the way.
   4. ask him to drive faster when it seemed safe to do so.
   5. suggest he slow down in traffic.

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Comparison of Attitudes Toward Intensive Competition for High School Girls[1]

ROSEMARY McGEE
Woman's College of the University of North Carolina
Greensboro, North Carolina

Abstract

This study summarizes attitudes toward intensive athletic competition for high school girls as expressed by administrators, teachers, and parents. A 70-item attitude scale constructed by a combination of the Thurstone and Likert methods was submitted to the respondents. The study population was composed of respondents from (1) some Iowa communities which sponsor intensive athletic competition for high school girls; (2) some Iowa communities which do not sponsor such competition; and (3) some Illinois communities where team competition for girls on the inter-school basis is not sanctioned. In general, administrators and teachers in all three groups were much less favorable to intensive competition than were parents and coaches.

COMPETITION IS a situation which children experience early and to which they must continually adjust. In some states, high school girls participate in an intensive inter-school basketball schedule. Other states allow no inter-school athletic competition for girls. Still others have occasional inter-school games in a situation where intensity is carefully controlled.

The idea of highly competitive athletic programs for high school girls seems to be meeting with divided opinions. Some parents are probably in favor; others are not. Some administrators are feeling pressure from their communities to adopt such a program. Teachers and supervisors, too, are involved in the issue. Some probably think that an intensive basketball program deprives the girls of a well-balanced, diversified physical education experience. Others think it is good because the girls may enjoy it and because it may provide these particular girls with an opportunity for a high degree of skill development.

Quantitative information about the attitudes of parents, physical education teachers, classroom teachers, and administrators is necessary before these questions as to social pressures can be more than mere conjecture. Administrators and physical educators will know better how to approach the problem after they have learned the existing attitudes of the various groups concerning inter-school competition in team sports for high school girls.

[1]This study was made in partial fulfillment of the requirement for the degree of Doctor of Philosophy in the Department of Physical Education for Women, Graduate College, State University of Iowa.

The purpose of this study is to ascertain and compare attitudes of school administrators, teachers, and parents toward intensive athletic competition for high school girls as measured by an objective attitude scale.

Definition of Terms

"Intensive athletic competition" in a team game is comparable to tournament basketball games. It involves crowds, intense excitement, publicity, gate receipts, and local community involvement. The competitive program is carried on with a regular schedule of practice sessions and an established calendar of contests with other schools.

Since attitudes are not themselves responses but states of readiness to respond, they may be inferred only indirectly from verbal responses. An "attitude scale" is employed to measure these verbal responses. It aims to place individuals at specified points on a continuum ranging from favorable to unfavorable attitudes (5).

Related Research

Much has been written on the general topic of competition. But attitude scale measurement has been employed by only a few authors to study this topic. Stalnaker (7), Moore (4), Carr (1), Wear (9), McCue (3), and Scott (6) have used various types of attitude scales to measure verbal responses toward competition and physical education. The Likert (2) and Thurstone (8) methods of scale construction were the two most widely used in these studies.

Procedure for Scale Construction

The investigator decided to use a scale constructed as the McCue and Scott scales had been developed for previous studies. This procedure makes use of an adaptation of the Likert and Thurstone techniques of scale construction.

The scale items were obtained from reading articles, books, yearbooks, editorials, and other attitude scales concerned with competition. The 82 items were submitted to 94 graduate students at the State University of Iowa. They made two different types of responses to the attitude scale at the first administration. The favorability rating was the first one. Each person indicated whether he thought each statement was favorable or unfavorable to girls competition. For example, one item from the scale reads, "participation in intensive competition teaches girls poise when meeting new people." If this statement is true, is it favorable to competition or unfavorable? The respondents answered on a five-point scale ranging from Extremely Favorable to Extremely Unfavorable with Neutral in the middle. This rating served to evaluate each item. If 70 per cent of the group agreed on the favorability or unfavorability of the item it was retained in the scale. As a result of the ratings, 12 of the 82 items had to be discarded.

The other response at this time was made on the basic of personal opinion about each statement. The five-point scale ranged from Strongly Agree to Strongly Disagree with Neutral in the middle.

Two weeks later the revised scale was administered a second time to the same group. This time they responded to the item only once: on the basis of their personal opinion about each statement. This rating, paired with the previous one of the same nature, served as the reliability measure for the scale and produced a reliability coefficient of .95.

The final form of the attitude scale was composed of 70 items divided into the following seven sub-sections: personality development, recreation, physical development and conditioning, public relations, health and safety, skill, and human relations. The items in the seven categories were not designed as measures of development, such as personality development, but rather they were concerned with *attitudes* about these seven general topics as they relate to competition. An attempt was made to word the statements so that the number of favorable and unfavorable items would be about evenly divided.

Selection of Study Population

Lists were made of all the Illinois schools; the Iowa schools belonging to the Iowa High School Athletic Union, which promotes intensive competition, referred to as the Member schools; and of the Iowa schools where there is not intensive competition for girls, referred to as Non-Member schools. Schools were selected at random from the lists until 100 communities, representing comparable size classifications and geographic distribution, had been obtained for each of the three groups.

Each superintendent agreeing to co-operate in the study was requested to have 17 specified persons respond to the scale. These included one administrator, the mathematics teacher, the social studies teacher, the boys' physical education teacher, the girls' physical education teacher, and 12 parents. The home economics teacher was designated as an alternate. The parents were to be selected at random by alternately picking from the alphabetical list of senior girls, junior girls, and on down until 12 names were available. This list of 12 high school girls was numbered. Then the fathers of the even-numbered girls and the mothers of the odd-numbered girls were asked to respond to the scale.

The final return included responses from 102 of the original 300 communities contacted representing a 34 per cent return. The Iowa Member schools had a 48 per cent return. The Ilinois schools and the Iowa Non-Member schools each had a 27 per cent return. The lack of complete returns from each group destroyed the randomness of the sampling. This limitation should be considered when interpreting the results. The usable responses provided a total of 1347 individual answer sheets for use in the analysis of the data.

Analysis of Data

The attitude scale permitted a range of total score from minus 70 to plus 70. A positive score was interpreted to indicate a favorable attitude while a negative score was interpreted to indicate an unfavorable attitude toward intensive athletic competition for high school girls.

The analysis of variance was employed to determine any significance of the differences between means since more than two groups were involved. If the subsequent F test was significant than t tests followed to analyze any combination of two means. Bartlett's test for homogeneity of variance was also applied to test the hypothesis that the groups were drawn from populations with a common variance. If this X^2 test indicated that it was not the variances which differed significantly, then any value of F which was significant was attributed to differences in the means.

The mean score of 20.86 for the Iowa Member group in Table 1 differs both from the 12.26 of the Illinois group and the 11.93 mean of the Iowa Non-Member group at the one per cent level of confidence. The means for all three groups are on the positive end of the scale and, therefore, indicate favorability toward intensive athletic competition for high school girls. The two lower means, even though on the positive end, differ significantly from the mean of the Iowa Member group which is also in favor of such a program but to a greater degree. The X^2 value of 7.27 is not significant at the one per cent level of confidence and indicates that the variances for these groups may be considered homogeneous.

TABLE 1

Mean Scores Made by the Three Total Groups and the Analysis of Variance

Groups	Number	S.D.	Mean	#[1]
Iowa Member	652	26.83	20.86	+
Illinois	347	29.12	12.26	+
Iowa Non-Member	350	30.20	11.93	+

Analysis of Variance

Sources	df	SS	MS	F[3]	P[3]
Groups	2	25894	12947.00	16.08	.01
Within Groups	1346	1083514	804.99		

[1]+Mean is significantly different at the 5-per-cent level of confidence from the neutral interval on the favorable side of the scale, i.e., the attitude score may be actually considered favorable.
—Mean is significantly different at the 5-per-cent level of confidence from the neutral interval on the unfavorable side of the scale, i.e., the attitude score may be actually considered unfavorable.
[2]Mean falls within the 5-per-cent confidence interval, indicating the neutral area of the scale, i.e., the attitude score may be actually considered neutral.
[3]F_{01} (2, 1346 df) = 4.60.
[4]In tables where this .01 is indicated, the difference is significant at the 1-per-cent level of confidence.

Tables 2, 4, and 6 summarize the findings for the various status categories in each of the three groups. Comparisons between the three groups of administrators, for example, may be made by selecting the mean scores for this status category from each of the three tables. Tables 3, 5, and 7 summarize the differences between the various combinations of means and indicate the differences which are significant at the one per cent level of confidence. Some of the differences which are not significant in the table are larger than others which are significant. This is caused by the uneven number of cases in each category and would not be the case had each category included the same

number of responses. Only those categories which contain at least ten cases are included in these tables.

Tables 2 and 3 show that the Iowa Member administrators, coaches, and parents are most in favor of intensive athletic competition for high school girls. The remaining groups of teachers are more neutral in their attitudes toward this topic. The X^2 value of 13.83 is not significant at the one per cent level of confidence and indicates homogeneity of variances. Consequently, the significant F in Table 2 may be attributable to differences in means somewhere among the status categories.

TABLE 2

Mean Scores Made by the Status Categories in the Iowa Member Group and the Analysis of Variance

Status Categories	Number	S.D.	Mean	#[1]
Administrators	48	29.80	13.15	+
Coaches	50	28.37	26.90	+
Boys Physical Education Teachers	10	23.77	35.50	+
Girls Physical Education Teachers	15	30.58	1.00	•
Mathematics Teachers	23	31.42	.70	•
Social Studies Teachers	21	29.55	9.86	•
Home Economics Teachers	18	27.28	10.33	•
Mothers—daughters have played on an interscholastic athletic team	136	23.07	28.07	+
Mothers—daughters have not played on an interscholastic athletic team	119	25.75	17.97	+
Fathers—daughters have played on an interscholastic athletic team	91	24.43	27.38	+
Fathers—daughters have not played on an interscholastic athletic team	102	23.41	18.96	+
Not indicated	19	25.10	24.37	+

Analysis of Variance

Sources	df	SS	MS	F	p[3]
Groups	11	39164	3560.36	5.29	.01
Within Groups	640	430460	672.59		

[1]See Table 1, footnote 1, for explanation of symbols.
[2]$F_{.01}$ (11, 640 df) = 2.29.

Tables 4 and 5 reveal that the administrators in the Illinois group are significantly unfavorable to intensive athletic competition for girls. They are most opposed by the coaches and parent groups. The Illinois group may likewise be considered homogeneous in variances since the obtained X^2 value of 9.09 is not significant at the one-per-cent level of confidence.

The parent groups in these Iowa Non-Member communities also show very favorable attitudes toward intensive competition for girls. Tables 6 and 7 substantiate this statement and reveal that the administrators and coaches are more neutral. The variances in the Iowa Non-Member group may also be

TABLE 3

Table of Differences Between the Means for the Various Status Categories in the Iowa Member Group

Status Categories	Mean	Differences									
		2	3	4	5	6	7	8	9	10	11
1. Administrators	13.15	13.75*	22.35	12.15	12.45	3.29	2.82	14.92*	4.82	14.23*	5.81
2. Coaches	26.90		8.80	25.90*	26.20*	17.04	16.57	1.17	8.93	.48	7.94
3. Boys Physical Education Teachers	35.50			34.50*	34.80*	25.64	25.17	7.43	17.53	8.12	16.54
4. Girls Physical Education Teachers	1.00				.30	8.86	9.33	27.07*	16.97	26.38*	17.96
5. Mathematics Teachers	.70					9.16	9.63	27.37*	17.27*	26.68	18.26*
6. Social Studies Teachers	9.86						.47	18.21*	8.11	17.52*	9.10
7. Home Economics Teachers	10.33							17.74*	7.64	17.05	8.63
8. Mothers—daughters have played on an interscholastic team	28.07								10.10*	.69	9.11*
9. Mothers—daughters have not played on an interscholastic team	17.97									9.41*	.99
10. Fathers—daughters have played on an interscholastic team	27.38										8.42
11. Fathers—daughters have not played on an interscholastic team	18.96										

*The starred differences are significant at the 1-per-cent level of confidence. The t for these differences exceeds 2.59.

considered homogeneous since the X^2 value of 11.04 is not significant at the one-per-cent level of confidence.

TABLE 4

Mean Scores Made by the Status Categories in the Illinois Group and the Analysis of Variance

Status Categories	Number	S.D.	Mean	#[1]
Administrators	20	23.69	−12.75	−
Coaches	21	28.41	12.48	+
Boys Physical Education Teachers	5	21.31	8.00	•
Girls Physical Education Teachers	26	31.05	− 2.42	•
Mathematics Teachers	11	28.14	−11.18	•
Social Studies Teachers	15	26.32	− .67	•
Home Economics Teachers	7	27.13	17.00	•
Mothers—daughters have played on an interscholastic athletic team	10	33.32	24.50	+
Mothers—daughters have not played on an interscholastic athletic team	128	26.61	13.95	+
Fathers—daughters have played on an interscholastic athletic team	6	13.75	28.67	+
Fathers—daughters have not played on an interscholastic athletic team	87	28.02	22.06	+
Not indicated	11	20.71	14.73	+

Analysis of Variance

Sources	df	SS	MS	F	p[2]
Groups	11	38815	3528.64	4.62	.01
Within Groups	335	255662	763.17		

[1]See Table 1 for explanation of symbols.
[2]$F_{.01}$ (11, 335 df) = 2.32.

TABLE 5

Table of Differences Between Means for the Various Status Categories in the Illinois Group

Status Categories	Mean	Differences					
		2	3	4	5	6	7
1. Administrators	−12.75	25.23*	10.33	1.57	12.08	26.70*	34.81*
2. Coaches	12.48		14.90	23.66	13.15	1.47	9.58
3. Girls Physical Education Teachers	− 2.42			8.76	1.75	18.37*	24.48*
4. Mathematics Teachers	−11.18				10.51	25.13*	33.24*
5. Social Studies Teachers	− .67					14.62	22.73*
6. Mothers — daughters have not played on an interscholastic team	13.95						8.11
7. Fathers—daughters have not played on an interscholastic team	22.06						

*These differences are significant at the 1-per-cent level of confidence. The t for these differences exceeds 2.59.

TABLE 6

Mean Scores Made by the Status Categories in the Iowa Non-Member Group and the Analysis of Variance

Status Categories	Number	S.D.	Mean	#[1]
Administrators	33	34.79	— 6.64	°
Coaches	31	25.02	7.32	°
Boys Physical Education Teachers	3	10.82	22.00	+
Girls Physical Education Teachers	10	28.98	—14.50	°
Mathematics Teachers	16	32.25	— 1.75	°
Social Studies Teachers	15	24.04	—12.67	—
Home Economics Teachers	10	22.50	4.00	°
Mothers—daughters have played on an interscholastic athletic team	6	32.40	21.17	°
Mothers—daughters have not played on an interscholastic athletic team	103	28.13	13.46	+
Fathers—daughters have played on an interscholastic athletic team	9	23.43	38.11	+
Fathers—daughters have not played on an interscholastic athletic team	93	26.57	21.35	+
Not indicated	21	21.68	27.71	+

Analysis of Variance

Sources	df	SS	MS	F	p[2]
Groups	11	52435	4766.82	6.04	.01
Within Groups	338	266888	789.61		

[1]See Table 1 for explanation of symbols.
[2]F_{01} (11, 338 df) = 2.32.

TABLE 7

Table of Differences Between Means for the Various Status Categories in the Iowa Non-Member Group

Status Categories	Mean	Differences 2	3	4	5	6	7	8
1. Administrators	— 6.64	13.96	7.86	4.89	6.03	10.64	20.10*	27.99*
2. Coaches	7.32		21.82	9.07	19.99	3.32	6.14	14.03
3. Girls Physical Education Teachers	—14.50			12.75	1.83	18.50	27.96*	35.85*
4. Mathematics Teachers	— 1.75				10.92	5.75	15.21	23.10
5. Socal Studies Teachers	—12.67					16.67	26.13*	34.02*
6. Home Economics Teachers	4.00						9.46	17.35
7. Mothers—daughters have not played on an interscholastic team	13.46							7.89
8. Fathers—daughters have not played on an interscholastic team	21.35							

*The starred differences are significant at the 1-per-cent level of confidence. The t for these differences exceeds 2.59.

Analyses were made on the seven sub-sections of the scale as well as on the total scale. The mean scores on the sub-sections for the Illinois and Iowa Non-Member groups were so similar that it was possible to combine these two groups. These mean scores were compared with those of the Iowa Member group and are summarized in Table 8. The two groups show almost parallel opinions about which outcomes are most favorably influenced by intensive athletic competition. The Iowa Member group, however, is consistently higher in its attitude concerning the favorability of each of the seven sub-sections.

TABLE 8

Means and Standard Deviations for the Seven Sub-Sections Based on the Means by Each Community in the Study and the t-ratios

Sub-Sections	Iowa Member N = 48		Iowa Non-Member Illinois N = 54			
	Mean	S.D.	Mean	S.D.	t-ratio	p[1]
A. Personality Development	5.09	2.15	3.88	1.93	2.95	.01
B. Recreation	1.27	1.87	— .20	1.96	3.88	.01
C. Physical Development & Conditioning	.80	2.34	— .64	2.14	3.20	.01
D. Public Relations	3.04	1.65	.98	1.98	5.71	.01
E. Health & Safety	4.23	1.30	3.30	1.29	3.59	.01
F. Skill	1.40	.91	.80	.89	3.32	.01
G. Human Relations	4.63	1.97	2.88	2.06	4.35	.01

[1]t (100 df) of 2.63 is necessary to be significant at the 1-per-cent level of confidence.

Conclusions

1. The mean attitude score of all respondents in the Iowa Member group is significantly higher than that of the Illinois group or the Iowa Non-Member group. There is no significant difference between the means of the Illinois and Iowa Non-Member groups. These three mean scores are low positive scores, indicating at least a slight preponderance of favorable attitudes in each group.
2. All of the parent groups show mean scores which are significantly positive. They seem to be in favor of intensive athletic competition for high school girls regardless of the group they represent.
3. When the different status categories are compared within their own group, certain tendencies become apparent.
   a. The administrators have a significantly lower mean scores then the coaches in both the Iowa Member and Illinois groups.
   b. The coaches and boys physical education teachers have a significantly higher mean score than do the girls physical education teachers and the mathematics teachers in the Iowa Member group.
   c. In general, the parents and coaches from all three groups are signifi-

cantly more in favor of intensive athletic competition for high school girls than are the administrators and other categories of school personnel.

4. The Illinois and Iowa Non-Member groups are in accord in their attitudes expressed on the seven sub-sections of the scale in which the items are grouped according to the outcomes of competition. They differ significantly from the Iowa Member group, rating these outcomes less favorably in each of the seven sections. Even though these two less competitive groups do not rate any of the seven sub-sections as high as the Iowa Member group does, they do seem to agree with them on the areas in which outcomes are most and least favorable. Outcomes in the areas of personality development, human relations, and health and safety are considered most favorable. Less favorably influenced by intensive athletic competition seem to be the areas of recreation, physical development and conditioning, public relations, and skill.

Discussion

The purpose of this study is to report opinions of school personnel and parents regarding intensive competition in basketball for high school girls. There is, of course, no attempt made here to submit evidence on the question as to whether this activity represents a sound educational program. However, the investigator is interested in speculating about the reasons for the opinions expressed.

When different communities differ in a program as controversial as girls basketball of the tournament type, it is to be expected that each group will support its own practice with some vigor. Therefore the differences between the Iowa Member group and the other two are not surprising. The likenesses may be more important.

Parents in all three groups agree in being favorable to the idea. School personnel in all three groups (with the exception of the coaches in some instances) agree in being less favorable than the parents. This same situation was found when Scott (6) studied attitudes toward intensive competition for elementary school children. Parents and school personnel must have different bases for their opinions. Influencing all of them are certain social pressures from our contemporary culture; the love of athletic spectacles, the desire to see an ultimate "winner" or "champion" determined, the prestige of publicity in press, radio, and television, local community pride, and the profits to the schools from gate receipts and to the tournament towns from visiting crowds. In addition, there is the vicarious satisfaction of seeing "success" come to their children; in a lesser degree it may be felt by teachers whose students are spotlighted for the moment of victory.

What is there in the experience of the school personnel which makes them less vulnerable to these social pressures, or at least has some influence in the opposite direction? First, of course, there is the professional responsibility of analyzing the curriculum in relation to long-term effects on the development

of children and youth. School personnel are trained to see many phases of this development and to weigh activities on the basis of whether they contribute positively or negatively to it. Moreover, they are committed by professional ideals and standards to select activities which contribute positively, rather than activities in which the positive is counterbalanced or outweighed by a very sizable negative contribution. Second, there is the weight of opinion among leading educational authorities which seems to be continuously in favor of less intense competition in girls athletics, in the form of intramurals or sports day interscholastics. Third, the school men and women know the whole school picture. They are able to judge the effect of athletic tournaments on the rest of the program. They know also whether the school has enough facilities and teachers to give all girls a chance to play as well as the more gifted ones. It is possible that some of these considerations, at least, affect the attitudes of school personnel.

REFERENCES

1. Carr, Martha G. The Relationship Between Success in Physical Education and Selected Activities Expressed by High School Freshman Girls. *Research Quarterly*, **16**: 176-191, 1945.
2. Likert, Rensis. Techniques for the Measurement of Attitudes. *Archives of Psychology*. No. 140. **22**: 1-55.
3. McCue, Betty F. Constructing an Instrument for Evaluating Attitudes Toward Intensive Competition in Team Games. *Research Quarterly*, **24**: 205-209, 1953.
4. Moore, Beverly. The Attitude of College Women Toward Physical Education Activity as a Means of Recreation. *Research Quarterly*, **12**: 720-725, 1941.
5. Newcomb, Theodore M. *Social Psychology*. New York. The Dryden Press, 1950.
6. Scott, Phebe M. Attitudes Toward Athletic Competition in Elementary Schools. *Research Quarterly*, **24**: 352-361, 1953.
7. Stalnaker, John M. Attitudes Toward Intercollegiate Athletics. *School and Society*, **37**: 499-504, 1933.
8. Thurstone, L. L., and E. J. Chave. *The Measurement of Attitude*. Chicago. The University of Chicago Press. 1929.
9. Wear, Carlos L. The Evaluation of Attitudes Toward Physical Education as an Activity Course. *Research Quarterly*, **22**: 114-126, 1951.

ATTITUDE SCALE

Directions for Answering the Items Pertaining to Intensive Athletic Competition for High School Girls

In recent years a growing number of comments regarding athletic programs for high school girls have been expressed by the public. Parents, school administrators, and teachers are interested in athletic competition. It seems to us very worthwhile to attempt to determine what these people think about the participation of high school girls in team sports involving intensive competition. Your response to the statements attached will help us to get data on your attitudes concerning this topic.

Your identity will remain unknown but some information about you is needed for grouping the data in various ways. Therefore, it will be necessary for you to fill in and check *all* of the blanks that apply to you *on the back of the answer sheet.*

By "intensive competition" for high school girls we mean those team games comparable to tournament basketball games and which involve crowds, intense excitement, publicity, and gate receipts.

We should like to have your personal reaction to each statement as it is presented. Do you agree or disagree with the statement? Even if the girls in your town have never participated in intensive competition what do you think the effects would be? Indicate your *own* opinion of the statement by making a heavy mark between the dotted lines opposite the item number on the answer sheet. The attitude items are in sections. Be sure to place your answers in the corresponding sections on the answer sheet. The numbers represent the following code:

Strongly Agree	Agree	Neutral or Indifferent	Disagree	Strongly Disagree
1	2	3	4	5

Use 3 *only* if you neither agree nor disagree with the statement. If you agree slightly with the item, cross out the 2; if you disagree slightly, cross out the 4.

Your responses to these items are not to be considered as correct or incorrect. We want your personal opinion about them. Remember, check each item as to whether you personally agree or disagree with the item in regard to intensive athletic competition for high school girls.

Items Pertaining to Intensive Athletic Competition for High School Girls

Section A: Place answers to the following items in *Section A* on the answer sheet.

1. Participation in intensive competition develops leadership.
2. There is a display of excessive emotion during and after girls' participation in intensive competition.
3. Participation in intensive competition trains individuals to face the problems of every day living.
4. The publicity used in intensive competition disturbs a player's sense of values which will have lasting effects for the future.
5. Participation in interscholastic contests develops mental alertness.
6. Tournament basketball develops such intensity of feeling that most girls playing cannot control their own emotional responses.
7. Interscholastic participation promotes a well-balanced outlook on life's values.
8. Since the coach must make the decisions in interscholastic competition, players lose the opportunity to plan their own plays and strategy.
9. Partcipation in intensive competition assists players to control their emotions.
10. Girls who participate in intensely competitive programs tend to develop masculine mannerisms and attitudes rather than feminine reactions.
11. Participation in intensive competition enhances the ego of shy individuals.
12. Intensely competitive participation creates a sense of achievement in the girl.
13. Intensive competition builds self-respect in the girl who participates.

Section B: Place answers to the following items in *Section B* on the answer sheet.

1. Girls should have the same opportunity as boys to enjoy the combative struggle of interscholastic basketball.
2. A high school girl who participates in interscholastic athletics specializes in them and so does not learn individual sports which she could play later in life.
3. Intensive competition at the interscholastic level is necessary for real enjoyment of the game.
4. The average American girl wants intensive athletic competition.
5. Participation in intensive competition enables girls to acquire a love for activity.
6. Most high schools do not have enough time or facilities to provide both for interscholastic team sports and recreational individual sports.
7. Intensive competitive participation in high school results in girls leading an active life in later years.

8. Participation in intensive competition does not provide relief from the stress and strain of modern living.
9. Membership on interscholastic teams limits the girl's interest in other school activities.

Section C: Place answers to the following items in *Section C* on the answer sheet.

1. A season of scheduled contests makes undue physical demands on girls.
2. Most coaches are primarily interested in developing and maintaining the physical welfare of the girls participating.
3. One of the best ways to build strength for the functions of womanhood is to engage in athletic contests.
4. Intense competition in active sports promotes better physical condition while participating.
5. Most girls playing interscholastic basketball games play beyond the stage of moderate fatigue to the point of exhaustion.
6. Intense athletic competition is more suited to the physical make up of high school boys than high school girls.
7. Girls in fit physical condition do not have abnormal emotional reactions.
8. Practice periods as well as games leave most girls on the school team over fatigued.
9. Intense competition in active sports promotes better physical condition in the years following participation.
10. Travel to and from distant games is excessively tiring to the players.
11. Participation during the menstrual period causes fatigue unnoticed until it has exceeded the ordinary limits.

Section D: Place answers to the following items in *Section D* on the answer sheet.

1. Participating in intensive competition before crowds of excited spectators makes too much emotional strain for most girls.
2. Participation in intensely competitive team events provides a very desirable outlet for a high level of energy.
3. The development of a girls' team is usually done at the cost of slighting the entire physical education program for the majority of girls.
4. Many secondary schools use their girls' athletic teams as a means of advertising.
5. The values received by high school girls from intensive interscholastic competition are insufficient to warrant large expenditures for equipment, travel, etc.
6. Interscholastic competitive games for girls stimulate school spirit more than interclass games.
7. A community derives prestige from the success of its girls' teams in intercity contests.
8. Girls' interscholastic athletic contests are the most effective device for girls to use to create community interest in the school.
9. Newspaper and radio reports on girls' contests increase support of the diversified physical education program for girls.
10. Most coaches find it desirable to do everything possible to get their teams to win.
11. Interscholastic competition gives girls equal opportunity with the boys to receive public recognition.

Section E: Place answers to the following items in *Section E* on the answer sheet.

1. Travel arrangements used by most teams are completely adequate for the safety and health of the team.
2. Most girls who play tournament ball are taught to maintain standards of practice that will increase their health and protect their safety.
3. Intensive participation presents greater danger of accidents than other phases of daily living.
4. The rules used in tournament games fail to consider the physical capabilities of girls.
5. Most coaches adhere to entirely adequate safety codes for their teams.

6. Adequate protective equipment is worn by the majority of interscholastic participants.
7. Most coaches are qualified to develop health and character as well as skill.
8. Most girls participating in intensive competition lack regular and adequate medical supervision.

Section F: Place answers to the following items in *Section F* on the answer sheet.

1. Training girls to make quick decisions and responses can be gained more rapidly from the more general physical education program than from the interscholastic type of competition.
2. The participant is usually trained to view athletics primarily in relation to the winning of individual records and team championships.
3. Participation in intensive competition teaches respect for the skilled player whether teammate or opponent.
4. Intensive competition meets the challenge of highly skilled players.
5. Intensive competition for girls places too much importance on trophies and awards.
6. Sufficient skill to satisfy the average individual is developed only through competitive interscholastic participation.

Section G: Place answers to the following items in *Section G* on the answer sheet.

1. Interscholastic participation develops responses useful in situations of emergency.
2. Participation in intensive competition makes girls less considerate for the rights of others.
3. Competitive athletic participation creates more loyalty to the school than does participation in other school activities.
4. Interscholastic participation teaches girls to win without boasting in public.
5. A girl receives few advantages from identification with an interscholastic team.
6. Membership on athletic teams prevents girls from associating with their normal social crowd.
7. Our society needs less competitive drive in girls and women than in boys and men.
8. Playing on an inter-class team develops more ability to cooperate than playing on a team competing intensively.
9. Participation in intensive competition teaches girls poise when meeting new people.
10. Participants in intensive competition develop respect for officials.
11. Emphasis on winning in intensive competition causes most players to forget the rights of their opponents.
12. Participation in competitive contests helps the participant adjust to others of her own age.

(Submitted 7/6/55)

Relationship Between Height, Jumping Ability, and Agility to Volleyball Skill

DOROTHY R. MOHR AND MARTHA J. HAVERSTICK
University of Maryland
College Park, Maryland

Abstract

One hundred and two women students at the University of Maryland enrolled in eight-week volleyball courses were given repeated volleys tests at 3-ft. and 7-ft. restraining lines. Their height was measured, and they were given tests of agility and vertical jumping. Correlations were computed between volleys tests and the other factors. From a study of these correlations, their significance, the differences between these correlations, and the significance of the differences, a significant relationship was found to exist between jumping and volleying, between agility and volleying, and between height and volleying at the 3-ft. distance.

AN EARLIER study was conducted at the University of Maryland in an attempt to establish the validity and reliability of the repeated volleys test in volleyball at a 7-ft. distance from the wall, as compared to 3-ft. and 5-ft. distances. The investigators observed that tall girls appeared to execute the test at the 3-ft. restraining line with ease and with single hits. When moved back from the wall to a 7-ft. distance, the ball had to be set up more frequently, and the height of the player seemed less advantageous. The test at the 7-ft. distance was found to be valid as well as reliable. A report of this study appeared in the May 1955 issue of the *Research Quarterly* (9).

However, since it was observed that short players also made high scores on the repeated volleys test at the 7-ft distance, the question of height and its possible relation to volleyball skill was still a puzzling one. Other questions also came to mind. Is agility an important factor in volleyball skill? Is vertical jumping ability of importance?

Statement of the Problem

In an attempt to gain further information for possible answers to the above questions, a study was made to discover the correlation between repeated volleys tests at the 3-ft. and 7-ft. distances and: 1. height; 2. agility; and 3. vertical jumping. One hundred and two women students at the University of Maryland enrolled in eight-week volleyball courses were tested during the fall semester of 1954-55.

Related Studies

In a study by Lamp (6) with junior high school boys and girls, the factor of height showed more relationship to the volleying test than to any of the other tests in volleyball (serve, set-up, and net-pass tests). The relationship

for girls was .470 and for boys was .643. The relationship might be due to the type of test used. The subject, after starting behind a 3-ft. restraining line, moved as close to the wall as he felt necessary in order to volley the ball against the wall successfully.

A study by DiGiovanna (4) substantiated the common claim by many coaches that body structure is associated with athletic success. The study further indicated an association of muscular strength and explosive power (as measured by a vertical jump) and athletic success. Differences shown between a male athletic group and a normal group in the vertical jump had critical ratios of 7.07 for basketball players and 8.15 for gymnasts, to mention only two.

Burley and Anderson (1) found that power as measured by the jump reach test is closely associated with athletic success. They reported that power is more closely associated with track, swimming, basketball, and baseball than with boxing and wrestling, tennis, and possibly football.

With a small group of senior boys in physical education, McCloy (8) found the correlation of certain track and field activities with the Sargent Jump to be .752; they had received instruction in all events. When another group of high school boys practiced the jump, but not the track and field events, to the same extent this correlation was .591. With a similar group of senior high school girls, the correlation was .582. After studying other groups in the same way, he concluded that the Sargent Jump when standardized, practiced, and correctly administered was undoubtedly a valuable test.

Carpenter (2), in her study with college women, found a correlation of .5267 between Sargent Jump and track and field scores. She felt that this demonstrated that there was a positive correlation between power and athletic performance as judged by track and field scores.

Reliability coefficients have been reported (3) for the Sargent Jump test as .85 and .96. The "chalk jump" test is a variation of the Sargent Jump. The test used in this study is a refinement of this variation.

Scott (10), in her work with the obstacle race test, found that changes in the original test were necessary in order to make it less time consuming, less dangerous and not a test to be feared. The hurdles were eliminated, and spots were drawn on the floor as a substitute for stools. The correlation between the first, or long, obstacle race and second, or short, one was .60. The reliability of the short race was .91. This was the test of agility chosen to be used in this study.

Procedure

In the last week of an eight-week unit of volleyball instruction in three University classes, the students were given the following tests.

Height was measured to the nearest quarter-inch, using a wall marking.

Repeated Volleys Tests were given according to the following descriptions, allowing rest between trials.

Equipment: Well inflated balls, unobstructed wall space 10 ft. long and 15 ft. high, stop watch. A line 10 feet long is marked on the wall, 7½ feet from the floor and parallel to the floor. Two other lines are marked on the floor, 10 ft. long, parallel to the wall, and 3 and 7 ft., respectively, from the wall.

Test: Player stands behind the 3-ft. line and tosses the ball to the wall with an underhand toss. When it returns, she volleys it repeatedly against the wall above the net line, for 30 sec. The ball may be set up as many times as desired or necessary to maintain control; it may be caught and re-started with a toss as at the beginning. If the ball gets out of control, it must be recovered by the player and brought back to the 3-ft. line to be started again with a toss. Three trials are taken at the 3-ft. line, and later, three trials at the 7-ft. line.

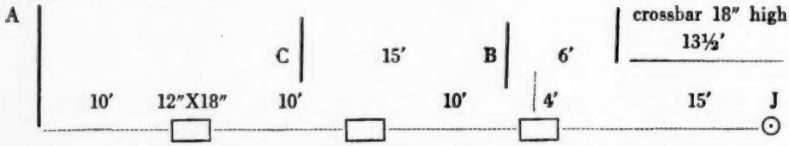
Scoring: The score for each trial is the number of times the ball is clearly batted (not tossed or held) from behind the proper line to the wall, on or above the net line there. One person in each group counts the volleyed hits on or above the line; another counts the times the player steps over the restraining line (telling her as she does so). The latter is subtracted from the former to obtain the score for the trial. The scores are totalled for each set of three trials.

Jump Reach Test was administered by using a wooden frame, constructed so that it was at right angles to a wall, and made up of wooden slats, each one inch shorter than the one before. The following describes the testing procedure.

Subject stands directly under the measuring frame with the preferred arm extended at full reach. The number of the shortest slat which she can touch is recorded. She moves away from the wall, still remaining under the frame, and jumps, attempting to touch the shortest possible slat. This must be a single vertical jump, with no preliminary run. She has three trials, and the number of the shortest slat touched is recorded. Her score is the difference between the two recordings.

Agility was measured by means of the Scott obstacle race, as described below.

Subject starts in a back-lying position on the floor with heels at line A in the diagram. On the signal, "Ready, Go!" she gets up and starts running toward the pole at J, stepping with both feet on each of the three spots on the floor, runs twice around J without touching the pole, turns toward D, crawls or rolls under the crossbar, gets up on the other side, runs to line C, back to B, and continues running between B and C until she comes to C for the third time. Score is the number of seconds and tenths of a second required to run the course.



After obtaining the scores on the above tests for the 102 students, the Pearson Product-Moment method of correlation was used to compute the coefficients between: jump reach and 3-ft. volleys; jump reach and 7-ft. volleys; height and 3-ft. volleys; height and 7-ft. volleys; agility and 3-ft. volleys; agility and 7-ft. volleys; and 3-ft. volleys and 7-ft. volleys. The significances of these correlations were checked by means of the appropriate formula. The differences between the correlations of each non-volleyball factor with 3-ft. volleys and 7-ft. volleys were computed, the standard errors of these

differences obtained, and the significances of the differences studied. For additional study of the relationship between height and volleying at both distances, partial correlations were computed, holding agility and jump reach constant.

Results

The correlations obtained and their significances were as follows:

Jump reach with 3-ft. volleys	.42, beyond 1% level
Jump reach with 7-ft. volleys	.46, beyond 1% level
Height with 3-ft. volleys	.24, between 1% and 5% levels
Height with 7-ft. volleys	.16, not significant
Agility with 3-ft. volleys	.42, beyond 1% level
Agility with 7-ft. volleys	.37, beyond 1% level
3-ft. volleys with 7-ft. volleys	.80, beyond 1% level

The significances of these correlations were studied by means of the table on page 212 of Lindquist (6). All correlations except those with height were significant beyond the one-per-cent level. The difference of .04 between the correlations of jump reach with 3-ft volleys (.42) and with 7-ft. volleys (.46) was found to be less than the standard error of that difference, which was .07. The difference of .08 between the correlations of height with 3-ft. volleys (.24) and with 7-ft. volleys (.16) was less than the standard error of that difference, which was .11. The difference of .05 between the correlations of agility with 3-ft. volleys (.42) and with 7-ft. volleys (.37) was also less than the standard error of that difference, or .08. The formulas used to compute the standard error of difference between two coefficients of correlation, involving two correlations having one variable in common, were found on pages 205, 223, and 224 of Guilford (4). All subjects were given the volleys tests in the same order, namely 3-ft. and then 7-ft. It is possible that the results would have been different if the order had been reversed with half of the subjects.

Using the formulas on pages 249 and 250 of Lindquist (6), the partial correlation of height and 3-ft. volleys, holding jump reach constant, was found to be .234, significant between the one and five percent levels. Holding agility constant, this was .304, significant beyond the one percent level. The partial correlation of height and 3-ft. volleys, holding jump reach *and* agility constant, was found to be .286, significant beyond the one-per-cent level. The findings were quite different at the 7-ft. distance. The partial correlations in the order stated above were .145, .204, and .165. Only that of height and 7-ft. volleys with agility constant was significant at the 5-per-cent level, and the others lacked even that degree of significance.

Conclusions

From the above figures, it can be concluded that with the subjects used in this study, a significant relationship was found to exist between jump reach and volleying, between agility and volleying, and between height and volleying at the 3-ft. distance. Since no significant differences were found between these correlations at the 3-ft. and 7-ft. lines, either distance could have been

used for jump reach and agility. Apparently, with these subjects height had little influence on performance at the 7-ft. line, but had some relationship to volleying ability at the 3-ft. line.

The earlier study reported by the authors (9) found the 7-ft. volleys test more valid than the 3-ft. test, and these data showed a significant relationship between height and the 3-ft. test but not the 7-ft. one. Thus, more evidence has been presented to support the hypothesis of the superiority of 7-ft. volleying over 3-ft. volleying, at least for University of Maryland women students. It is suggested that further data be obtained in this and other situations to compare with the findings of this study.

Recommendations for Further Study

Since the repeated volleys tests correlated significantly with the scores on the obstacle race and the jump reach, it would be of interest to investigate the following:

1. Would agility exercises performed throughout the volleyball instructional period increase the agility and playing ability of students?
2. Would there be an increase in agility simply through participation in volleyball, and what would the comparison be with another group having agility exercises in addition to volleyball?
3. Would there be an increase in jumping ability after volleyball instruction for an eight-week period?
4. In those players whose jumping ability did increase, would there be a comparable increase in their volleyball skill?
5. Is it worthwhile to spend some of the volleyball instructional time on jumping practice and agility exercises?

REFERENCES

1. Burley, Lloyd R., and Roy L. Anderson, Relation of Jump and Reach Measures of Power to Intelligence Scores and Athletic Performance. *Research Quarterly*, **26**: 28-35, March 1955.
2. Carpenter, Aileen, A Critical Study of the Factors Determining Effective Strength Tests for Women. *Research Quarterly*, **9**: 3-32, Dec. 1938.
3. Clarke. H. Harrison. *Application of Measurement to Health and Physical Education*. New York: Prentice-Hall, Inc., 1950.
4. DiGiovanna, Vincent, The Relation of Selected Structural and Functional Measures to Success in College Athletics. *Research Quarterly*, **14**: 199-216, May 1943.
5. Guilford, J. P., *Fundamental Statistics in Psychology and Education*. New York: McGraw-Hill Book Co., Inc., 1950.
6. Lamp, Nancy A., Volleyball Skills of Junior High School Students as a Functior of Physical Size and Maturity. *Research Quarterly*, **25**: 189-200, May 1954.
7. Lindquist, E. F. *Statistical Analysis in Educational Research*. Boston: Houghton Mifflin Co., 1940.
8. McCloy, C. H., Recent Studies in the Sargent Jump. *Research Quarterly*, **3**: 235-247, May 1932.
9. Mohr, Dorothy R., and Martha J. Haverstick, Repeated Volleys Tests for Women's Volleyball. *Research Quarterly*, **26**: 179-184, May 1955.
10. Scott, M. Gladys, Motor Ability Tests For College Women. *Research Quarterly*, **14**: 402-405, December 1943.

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Relationship Between Psychological Capacities and Success in College Athletics

EINAR A. OLSEN
Texas Western College
El Paso, Texas

Abstract

Three groups of college males, designated as athletes, intermediates, and non-athletes, were given tests designed to measure reaction time, depth perception, and span of apprehension. Analysis of the test data revealed significant differences between the three groups. Athletes were found to be superior to non-athletes in all tests and superior to intermediate athletes in reaction time.

The "psychological capacity" scores and certain sports skills scores of varsity athletes were compared. Correlations found were generally low and non-significant.

THE STUDY OF various psychological factors such as reaction time, emotions, visual acuity, attention, intelligence, motivation, and perception and their relationship to motor ability has become increasingly popular with physical educators in recent years. Many factors are already recognized as contributing to athletic success, and undoubtedly, further experimentation in this area will reveal still more.

Purpose of the Study

The purposes of the present study[1] were (1) to determine whether significant differences existed in reaction time, depth perception, and visual span of apprehension between groups of varsity athletes, intermediate athletes, and non-athletes at Boston University, and (2) to determine the relationship, if any, of these three psychological capacities to selected sports skills in basketball, soccer, hockey and baseball.

PART I

Review of the Literature

Reaction Time. Griffith (15), one of the earliest psychologists who attempted to discover the relationship of reaction time to athletic ability, found significant differences in the reaction speed of athletes. Miles (21) found that reaction time was slower when measured by a complicated response. Tuttle and Westerlund (29) reported a high relationship between reaction time and running speed, and Tuttle and Lauterbach (20) found a similar relationship between running and reflex time. Beise and Peasely (5), Keller (19), and

[1]This study was made in partial fulfillment of the requirements for the degree of Doctor of Education, School of Education, Boston University. The writer is indebted to Dr. John M. Harmon, Chairman, Department of Physical Education, for his advice and criticism.

Cureton (9) found athletes to have a faster reaction time than non-athletes. Winograd (32), however, using Keller's "quickness of body movement" test, found no significant relationship between batting average, slugging average, runs batted in, and reaction time. Reaction time differences between groups of athletes have been reported by Cuerton (9) and Burley (7). These studies indicate that significant differences exist between skilled performers and non-performers in reaction time and also that reaction time has a definite relationship with certain motor skills.

Depth Perception. Depth perception is defined by Armstrong (1, *p. 71*) as "the ability to appreciate or discriminate the third dimension, to judge distance, and to orient oneself in relation to other objects within the visual field." The relationship of depth perception to athletics has never been fully established. Clark and Warren (8), found no significant differences between a group of athletes and non-athletes, and concluded that "either depth perception is relatively unimportant in athletics or their instrument did not measure depth perception accurately." Banister and Blackburn (2) suggested, but did not show, that stereoscopic vision might be a factor in batting a ball. It would seem from the few studies investigating depth perception in athletics, that little if any relationship exists between the ability to discriminate distance of objects and motor performance. However, extensive studies with this visual ability have been made in the field of aviation. Several writers (1, 3, 4, 18, 22) have suggested the importance of depth perception to flying and landing aircraft and to gunnery skill. Their evidence, though not conclusive, does suggest that further investigation with depth perception and motor ability is warranted.

Span of Apprehension. Investigation of the visual span of apprehension and its relation to athletic ability has been suggested (24, *p. 279*), but not reported. Woodworth (33, *p. 692*) defines visual span of apprehension as "the number or range of objects, letters or words that can be recognized, in a single fixation of the eye, well enough to permit immediate report on what has been seen." Span experiments were first inspired by the philosophical question whether the mind could apprehend more than one object at a time. Woodworth reports that the earliest span experiments were made by Jevons, who determined his "span of apprehension" by throwing a quantity of beans in a box and estimating their number without hesitation.

The development of the tachistoscope, an instrument which presents stimuli at a timed exposure, took much of the inaccuracy out of span experiments. Early tachistoscopes are described by Whipple (31, *p. 265*), Dodge (10), Glanville (14), and Fernberger (12). Many recent experimenters have used some type of lantern slide projector, mounted with a camera shutter as described by Eames (11), or a revolving disc in front of the lens developed by Newhall (23). Stimulus objects have most commonly been black dots scattered haphazardly over a white background and exposed for a period of 100-200

msec. Results of these studies showed that individual spans differed for number of dots apprehended all the way from six to 11, and each individual varied from trial to trial about his own average.

Eames (11), Sutherland (26), and Tinker (27) have reported a relationship between span of apprehension and rate of reading, and Flanagan (13) reported experiments investigating the effect of span training on the proficiency of identifying aircraft. Whether or not span of apprehension is a factor in athletic ability has not been determined, but it was considered worthy of consideration for the present study. The athlete is often called upon to make "snap" judgments in game situations and his response is determined both by his ability to apprehend certain stimuli which appear in his visual range and his ability to comprehend and to act upon what he has seen. Span of apprehension may, to some degree, measure these abilities.

Procedure

The Experimental Groups. The three groups of volunteers, each containing 100 male students, were designated as the "Athletic Group," "Intermediate Group," and the "Non-Athletic Group."

The Athletic Group consisted of 100 male athletes who had earned a varsity sports letter at Boston University.

The Intermediate Group included 100 male students who had never earned a collegiate varsity letter, but who either participated in the University's intramural program, were members of a junior varsity squad or participated in other recreation programs. These other recreation programs were limited to church and YMCA programs and to recreational participation in sports such as bowling, golf, tennis, and skiing. The intermediate group also included a few men out for varsity track, but who were not considered varsity material by the coach.

The Non-Athletic Group was made up of 100 male students who did not participate in any of the athletic programs at Boston Universtiy and who had never participated in such programs in the past, either in college, in high school, or elsewhere.

Reaction-Time Apparatus. The Stoelting Visual Reaction Timer[2] was selected for measuring reaction time. The instrument included a control cabinet, telegraphic keyboard, and a light-stimulus source.

The reaction keyboard consisted of three telegraphic keys mounted on a 6 x 13 inch wooden base. This keyboard was fastened to a ¾ inch plywood base measuring 16 x 25 inches. A two-level wooden hand-rest immediately in front of the keyboard raised the subject's hand to key level. At the beginning of each test, the subject, who was seated, placed his middle finger in the starting point on the handrest, 1⅛ inches in front of the middle key, with

[2]C. H. Stoelting Company, 424 North Homan Avenue, Chicago, Illinois.

the heel of the hand on the lower hand-rest (Figure I). The light stimulus source was mounted on the plywood base directly ahead of the subject.

An 18-inch plywood shield hid both the control cabinet and the operator's hand from the subject's view. The 3-way switches on the control cabinet allowed the operator to select the color of the stimulus (amber, red, green) and the corresponding telegraphic key.

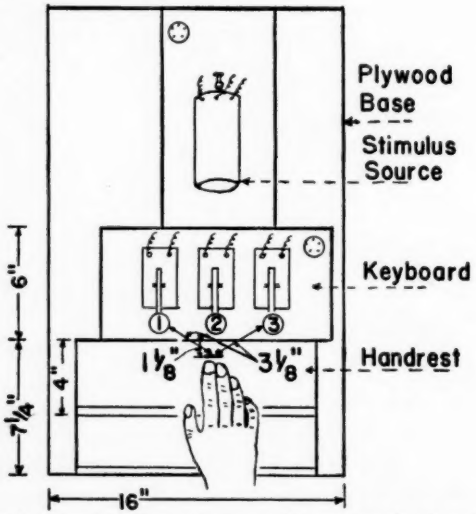

FIGURE I. Part of the Reaction Time Apparatus Illustrating the Locations of the Light Stimulus Source, Keyboard, and Handrest.

Reaction-Time Tests. Three separate tests were used in measuring an individual's reaction time. These were (1) a simple reaction-time test using one stimulus and demanding one response, (2) a choice reaction time test using two stimuli and demanding two different responses, and (3) a discriminatory reaction-time test using three stimuli and demanding three different responses.

The subject took all three tests at one sitting and each subject took the simple reaction-time test first, the choice reaction-time test next, and the discriminary reaction time test last. The test was purposely set up in this manner so that the subject would become increasingly familiar with the instrument as the tests increased in complexity.

Verbal directions and six or seven practice trials were given for each test. Each trial was preceded by a verbal "ready" signal. The stimulus was presented from two to four seconds after this signal, the same pattern being used for each subject.

In the simple reaction time, the subject moved his hand when the red light appeared and depressed the middle key, thereby stopping the chronoscope

on the control cabinet. The chronoscope, marked off in units of .01 seconds, was interpolated to .001 by the operator. Eleven trials were recorded.

Choice reaction time was measured in the same manner as above except that only the left and right keys were used. The left key corresponded to an amber light and the right to green. Eleven trials were recorded.

The discriminatory reaction-time test made use of all three keys. The subject and operator reviewed the keys and their corresponding colors. Practice trials were not considered necessary. Again, as in the preceding tests, the length of foreperiod preceding the presentation of the stimulus and the choice of colors was varied according to a set pattern, which was the same for each subject.

In each test the median of 11 readings was used as the individual's test score.

Depth Perception Apparatus. The instrument selected for measuring depth perception was the Howard Dolman Apparatus (6).

The apparatus consists of a box 24 in. long, 11¾ in. wide, and 12½ in. high, open at the sides and top. The end of the box nearest the subject being tested, has a rectangular window 3 in. high and 7½ in. wide. Inside the instrument are two vertical black rods, one of which is fixed at the center of the box and the other is movable on a track. The two rods are 2½ in. apart when they are in a plane perpendicular to the observer. The movable rod is controlled by two strings, which are placed in the subject's hands at the beginning of the test. A millimeter scale is set along the movable rod track. The center point of the scale, directly opposite the fixed rod, is marked 0, and the scale ranges from 0 to 200 mm. (away from the observer) and from 0 to 200 mm. (toward the observer).

Following Sieger's (25) recommendations to eliminate any shadows, the inner walls of the box were papered with heavy white non-gloss paper. Two 75-Watt, non-glare (Verd-A-Ray) bulbs were used for illumination. One bulb was placed in line with the front of the box and 2 feet above. The other light was 1 foot to the rear of the first light, directly over and 2 feet above the center of the apparatus. These lights, the only illumination used during the test, were shielded from the subject's eyes by a heavy black cloth stretched over a 24 by 12 in. frame firmly attached to the front of the instrument.

Depth-Perception Test Procedure. The test was explained to each subject. He was allowed to look at the instrument, manipulate the strings, and ask questions about procedure. He was then seated in a chair 20 feet from the instrument, head rested back against a board, and began the test of ten trials.

At the beginning of each trial the movable rod was placed at the extreme front or back of the instrument. This was done according to a set pattern with the tester standing in front of the instrument so that the rods were hidden from the subject's view. The mean of ten trials, rounded off to the nearest whole millimeter, was used as the individual's depth-perception score.

Originally the Howard-Dolman test used only three trials, but Imus (17) increased the reliability of the Howard-Dolman test by using ten trials instead of three. Weymouth and Hirsch (30), and Warren (28), achieved the same results by increasing the number of trials.

Span of Apprehension Apparatus. The instrument used in the span of apprehension test was first suggested by Eames (11). A tachistoscope was constructed by mounting a Number 4 Betaz Wollensak Shutter on a Spencer Delineoscope, Model M. C. (115 V 60 C. Y. C. Maximum, Lamp Wattage 300). The camera shutter was mounted on the 5-in. objective on the delineoscope by means of an aluminum sleeve with outer diameter of 2½ in. and inner diameter of 1⅞ in. The shutter was threaded to the sleeve, and the sleeve fastened to the projector objective by an adjustable setscrew. The shutter was set at 0.2 sec. exposure.

The Span Test. The span of apprehension test consisted of fifty 2 by 2 in. glass slides containing 4 to 13 black dots. Each slide was capable of being used in four different orientations.

The first step in the construction of the slides was to haphazardly arrange ¼-in. red signal dots on 5 by 5 in. square white cards. There were five sets of ten cards, with 4 to 13 dots in each set, five cards with 4 dots, five cards with 5 dots, etc.—50 cards in all. The cards were thoroughly shuffled, numbered 1 through 50, then photographed on negative film. During the photographing, the cards were reduced to a 2 by 2 in. size. The negatives were transposed to positive film, and the resulting pictures mounted into 2 by 2 in. glass slides.

The slides were then numbered in the order in which they had been photographed, with a white ink numeral in the upper right hand corner of the slide, on the black tape margin. Slides were numbered 1 through 50. The slides were then turned 90° to the right and numbered again, this time 51 through 100. Slide number 50 became number 51 and slide number 1 became number 100.

The slides were again turned 90° to the right, and beginning with 26-50 and following with 1-25, the slides were numbered 101 through 150. The slides were turned 90° to the right for the third time, and numbered 151-200, beginning with 50-26 and ending with slides 25-1. Four slides are illustrated in Figure II.

The above procedure made it possible to have 200 presentations in the test, using only 50 slides, and simplified test administration. Each of the numbers 4 to 13 were presented 20 times.

The testing room measured 21 by 16 ft. A 48 by 48 in. glass-beaded screen was mounted on one wall, 38 in. from the floor. In the center of the screen was a white circular spot ½ in. in diameter used as a fixation point during the span test. The tachistoscope, set on a table, was 12 ft. from the screen. When the slides were projected the dots were 2 in. in diameter.

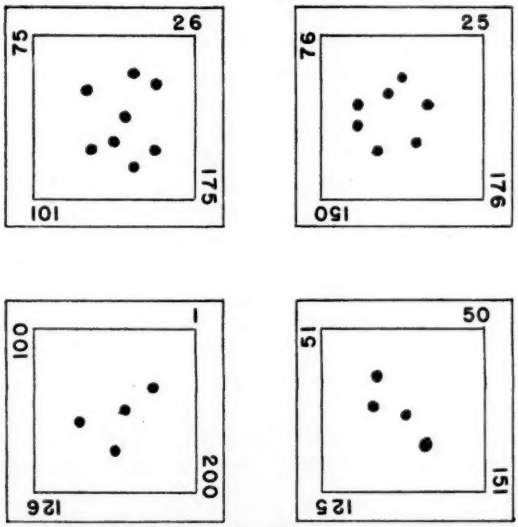

FIGURE II. Four Slides from the Span of Apprehension Test Illustrating the Arrangement of Dots and the Numbering of the Slides.

A shaded 60 watt non-glare light was placed at the back of the room 21 ft. from the screen and 8 ft. up from the floor. The light provided illumination for the answer sheets on which the subjects wrote their responses, and also provided for a pre-exposure field and a post-exposure field on the screen.

Four chairs were placed 20 ft. from the screen. The inner two chairs were 3 ft. on either side of a spot in direct line with the tachistoscope and the screen. The outer two chairs were 6½ ft. on either side of the same spot. The subject's view was not obstructed by the tachistoscope or the operator. It was possible to test four subjects at one time, but seldom more than two subjects were actually tested.

The seven essentials of a tachistoscope listed by Whipple (31, *p. 264*) were used as a guide in setting up the span test procedure. The exposure time of 0.2 sec. was considered short enough to preclude any effective eye movements. The dots, when exposed on the 48 by 48 in. screen, did not actually cover more than a 36 by 36 in. area, and this small exposure field was assumed to be well within the ocular field of the subjects.

The camera shutter allowed simultaneous exposure of all parts of the field. Sudden transitions from dark to light or light to dark were eliminated by the light in the back of the room. Persistent after-images were avoided by this same post-exposure field.

Span Test Procedure. Each subject was given a score sheet with numbered spaces for 200 answers, verbal directions for the test, and intructed to write down the number of dots they saw exposed each time. A 2-second foreperiod

following a verbal "ready" signal was used before each presentation of a slide in order to have adequate readiness on the part of the subjects. A two-minute rest period was held after each 50 presentations.

Span Test Scoring. The method of scoring span of apprehension tests has varied. Fernberger (12) suggested computing the statistical limen, or that stimulus value for which correct responses are given in 50 per cent of the cases. Woodworth (33, *p. 690*) pointed out that this would give scores ranging from 6 to 11. The technique of assigning credit for all correct responses and using the total number of correct responses as the span score used by Whipple (31, *p. 282*), and others was selected for this study.

It was evident, after the subjects were tested, that the range of these total correct responses would be too large for ordinary statistical treatment; therefore each total score was divided by 10 and rounded off to the nearest whole number.

Treatment of Data

Analysis of Variance. The procedures followed produced data on five psychological capacity tests for 300 students, divided equally into three experimental groups.

To determine whether significant differences existed between the groups the writer applied the analysis of variance technique (16, *p. 236*). Two distinct estimates of the population variance, deviation within sets and deviation between sets were obtained. The significance of the F-ratios, the ratio between the two estimates of variance, was determined from Snedecor's table (16, *p. 612*).

All F-ratios were significant beyond the 1-per-cent level and it is unlikely that differences as large would appear in random samples selected from the same population. The F-ratio for the simple reaction-time data was 55.76; for choice reaction time, it was 35.12; for discriminatory reaction time, 34.92; for depth perception, 17.38; and for span of apprehension, 10.42.

Critical Ratios. Following the analysis of variance, which provided an overall estimate of the significance of the differences, separate tests of the difference between pairs of groups were made. The means for the experimental groups are shown in Table 1 and the t-ratios and their levels of significance in Table 2.

TABLE 1

Means and Standard Deviations for the Experimental Groups in the Psychological Capacity Tests

Variable	Athletic Group		Intermediate Group		Non-Athletic Group	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Simple Reaction Time, msec	290	26.7	311	32.5	343	44.2
Choice Reaction Time, msec.	442	48.0	459	49.7	505	64.9
Discriminatory Reaction Time, msec.	486	53.7	513	51.9	557	72.5
Depth Perception, mm.	18.89	13.52	20.22	10.95	30.84	20.69
Span of Apprehension, dots	81.35	14.58	77.96	13.10	71.06	19.99

TABLE 2

Critical Ratios Between Means of the Three Groups in Reaction Time, Depth Perception and Span of Apprehension

Variable	Athletes vs Intermediates		Athletes vs Non-Athletes		Intermediates vs Non-Athletes	
	CR	Level of Significance	CR	Level of Significance	CR	Level of Significance
Simple RT	4.75	.001	10.15	.001	5.92	.001
Choice RT	2.51	.02	7.80	.001	5.58	.001
Discriminatory RT	3.33	.001	7.83	.001	4.82	.001
Depth Perception	1.33	not significant at .02 level	4.83	.001	4.53	.001
Span of Apprehension	1.73	not significant at .02 level	4.53	.001	2.88	.01

Reliability of the Tests. Pearson product-moment correlations between "chance halves" and the Spearman Brown prophecy formula were used to determine the reliability of the psychological capacity tests. Chance halves in the reaction-time tests were determined by letting the median of the last five odd-numbered scores constitute one-half and the median of the five even-numbered scores constitute the other.

The technique used for determining chance halves in the depth-perception test was similar except the mean of odd-numbered scores was used for one-half and the mean of even-numbered scores for the other.

In the span of apprehension test, split halves were used. This test was so constructed that the second half was actually a repetition of the items used in first half, except in a different order.

All of the estimates of reliability were made from 100 cases randomly selected from the total 300 cases.

The highest estimate of reliability was +.936 for simple RT. Other reliability estimates were +.740 for choice RT; +.743 for discriminatory RT; +.893 for depth perception; and for span of apprehension +.844.

Conclusions

Three groups of 100 each (athletes, intermediate athletes, and non-athletes) were tested on simple, choice, and discriminatory reaction time; depth perception; and span of apprehension. Analysis of variance showed significant differences between groups at the 0.1 per cent level. Further analysis of between group differences with critical ratio led to the following conclusions.

1. The athletes had faster simple RT, choice RT, and discriminatory RT than the intermediate athletes and non-athletes.
2. The intermediate athletes were faster in simple RT, choice RT, and discriminatory RT, than the non-athletes.
3. The athletes and the intermediate athletes had better depth perception than the non-athletes.
4. Both athletes and intermediate athletes had a higher span of apprehension score than the non-athletes.
5. Significant differences were not found between the athletes and the intermediate athletes in depth perception and span of apprehension.

PART II

Procedure

At the time of this study, various sports skills tests had been administered by other investigators to groups of athletes at Boston University. Since most of the athletes thus tested were included in Part I of this study an attempt was made to determine the relationship between the psychological test scores of these athletes and their sports skills scores.

Soccer. A soccer ability test comprised of four items—distance kicks, obstacle dribble, placement kick for accuracy, and goal kick for accuracy—was given to 21 varsity soccer players. T-scores were computed. Pearson product-moment coefficients of correlation between the five psychological test scores and the soccer test scores were determined. Correlations ranged from —.184 for depth perception and soccer ability score to +.477 for soccer ability score and discriminatory reaction time.

Baseball. A baseball skills test, consisting of four items—accuracy throw, distance throw, base running speed, and batting average for season—was given to 13 varsity baseball players. T-scores were computed and Pearson r's determined as above. Correlations ranged from —.075 for depth perception and the baseball test to +.496 for choice reaction time and the baseball test score.

Hockey. The five psychological test scores were administered to 26 varsity hockey regulars, centers, and forwards, from five colleges in the Boston area. The average number of goals and assists per game made by each player for the season was used as a measure of individual offensive hockey ability. Pearson product-moment coefficients between the hockey ability scores and the psychological capacity tests ranged from —.172 for depth perception to +.398 for simple reaction time.

Basketball. Fifteen varsity basketball players were given a basketball test containing four items—wall bounce for speed, speed dribble, dribble and shoot, and cup reaction-time test. Coefficients of correlation were determined as above, and were found to range from —.230 for choice reaction time and the basketball test score to +.395 for simple reaction time.

Conclusions

The simple RT, choice RT, and discriminatory RT, depth perception, and span of apprehension scores of small groups of athletes were correlated with sports skills to determine whether significant relationships existed.

Of 20 correlations, only two were considered significant at the .05 level of confidence: +.477 for discriminatory RT and soccer ability; and +.395 for simple RT and offensive hockey skill.

Undoubtely the selection of small homogeneous groups of varsity athletes for comparison biased the data toward finding low correlations. The methods used for comparison, however, may have significance to investigators with opportunity to test large, heterogeneous groups.

SELECTED REFERENCES

1. Armstrong, H. G., *Principles and Practices of Aviation Medicine.* Baltimore: Williams and Wilkins, 1939.
2. Banister, H., and J. H. Blackburn, An Eye Factor Affecting Proficiency at Ball Games. *British Journal of Psychology,* **21:** 382-384, 1931.
3. Barr, E. S., *Flying Men and Medicine,* New York: Funk and Wagnalls, 1943.
4. Bauer, L. H., *Aviation Medicine.* New York: Oxford University Press, 1943.
5. Beise, D., and V. Peasley, The Relation of Reaction Time, Speed, and Agility of Big Muscle Groups to Certain Sports Skills. *Research Quarterly,* **8:** 133-142, 1937.
6. Berens, C., and J. Zuckerman, *Diagnostic Examination of the Eye.* Philadelphia: Lippincott, 1946.
7. Burley, L. R., A Study of the Reaction Time of Physically Trained Men, *Research Quarterly,* **8:** 133-142, 1937.
8. Clark, B., and N. Warren, Depth Perception and Interpupillary Distance as Factors in Proficiency in Ball Games. *American Journal of Psychology,* **47:** 485-487, 1935.
9. Cureton, T. K., Jr., *Physical Fitness of Champion Athletes.* U. of Illinois Press, 1951.
10. Dodge, R., An Improved Exposure Apparatus. *Psychological Bulletin,* **4:** 10-13, 1907.
11. Eames, T. H., A Study of the Speed of Word Recognition. *Journal of Educational Research,* **31:** 181-186, 1937.
12. Fernberger, S. W., A Study of the Range of Visual Apprehension. *American Journal of Psychology,* **32:** 121-133, 1921.
13. Flanagan, J. C., *The Aviation Psychology Program in the Army Air Forces,* Research Report Number One, Washington, D. C., U. S. Govt. Printing Office, 1948.
14. Glanville, A. D., and K. M. Dallenbach, The Range of Attention. *American Journal of Psychology,* **41:** 577-594, 1929.
15. Griffith, C. R., *Psychology and Athletics.* New York: Chas. Scribner's Sons, 1928.
16. Guilford, J. P., *Fundamental Statistics—Psychology and Education.* New York: McGraw-Hill, 1950.
17. Imus, H. A., Visual Examination of Flyers Returned from Combat. *Journal of Aviation Medicine,* **19:** 62-93, 1948.
18. Kafka, M. M., Military Pilot's Vision, *N. Y. Medical Record,* **155:** 339-340, 1942.
19. Keller, L. F., The Relationship of "Quickness of Bodily Movement" to Success in Athletics. *Research Quarterly,* **13:** 146-155, 1942.
20. Lauterbach, R. and W. W. Tuttle, Relationship Between Reflex Time and Running Events in Track. *Research Quarterly,* **3:** 138-143, 1932.
21. Miles, W. R., Individual and Group Reaction Time in Football Charging. *Research Quarterly,* **2:** 5-13, 1931.
22. Millis, J. W., Depth Perception as an Aid in the Selection of Fighter Pilots. *Journal of Aviation Medicine,* **15:** 328-339, 1944.
23. Newhall, S. M., Tachistoscopic Projector. *Amer. Jl. of Psychol.,* **48:** 501-503, 1936.
24. Research Council, AAHPER, *Research Methods Applied to Health, Physical Education and Recreation.* Washington, D. C.: American Assn. for Health, Physical Education, and Recreation, 1949.
25. Seiger, H. W., Variations in Illumination of the Depth Perception Apparatus. *Journal of Aviation Medicine,* **15:** 401-403, 1944.
26. Sutherland, J., Relationship Between Perceptual Span and Rate of Reading. *Journal of Educational Psychology,* **37:** 373-380, 1946.
27. Tinker, M. A., Visual Apprehension and Perception in Reading. *Psychological Bulletin,* **22:** 223-240, 1929.
28. Warren, N. A., Comparison of Standard Tests of Depth Perception. *American Journal of Optometry,* **17:** 208-211, 1940.
29. Westerlund, J. H., and W. W. Tuttle, Relationship Between Running Events in Track and Reaction Time. *Research Quarterly,* **2:** 95-100, 1931.

(Submitted 2/23/55)

Comparison of Fencers and Nonfencers by Psychomotor, Space Perception and Anthropometric Measures[1]

WILLIAM R. PIERSON
Michigan State University
East Lansing, Michigan

Abstract

Twenty-five fencers and an equal number of nonfencers were compared as to eight psychomotor measures and six anthropometric measures. A statistical analysis of the data revealed speed of arm movement to be the only discriminatory item. Further analysis demonstrated that there is no correlation between arm span and speed of arm movement, arm span and reaction time, or speed of arm movement and reaction time.

IT IS THE OPINION of many fencing coaches and physical educators that fencers and nonfencers differ in "quickness" as well as in body build. The purpose of this study is to compare fencers and nonfencers in respect to certain traits and abilities which might logically be assumed to be related to success in the sport. The principal question to be answered is, "Do fencers and nonfencers differ in speed of arm movement, space perception, the ability to make rapid correct judgments, and certain reactive and anthropometric measures?" Of secondary concern are correlations between selected test items.

Review of the Literature

In general, fencing experts agree that fencers are superior to nonfencers in speed of movements, reactions, and decisions appropriate to fencing. No objective research has been done to substantiate this.

Henry (3) and Slater-Hammel (7) have demonstrated that movement and reaction times are independent and Rarick (6) that normal individuals with a high degree of motor ability cannot appreciably increase their speed of muscular movement. The study of Westerlund and Tuttle (10) indicates a positive correlation between running events in track and reaction time. If differences between fencers and nonfencers do exist, it would be expected that reaction rather than movement would be the discriminating factor.

Procedure

Fifty volunteer subjects, of whom 25 were fencers and 25 nonfencers, were tested under laboratory conditions. The group of fencers was composed of

[1]This study was made in partial fulfilment of the requirements for a Master's degree in the Department of Health, Physical Education and Recreation, Michigan State University, 1953.

varsity fencers from five major universities and the nonfencers were from service classes at Michigan State College. All subjects were naive as to the purposes of the tests.

Items selected for measurement were those abilities which by their very nature might be assumed to be important in fencing and selection was arbitrary. However, since fencing utilizes none of the basic skills of running, throwing, or jumping, it was felt that items which were not specific to the sport and did not involve any of these basic skills would be impartial.

MOVEMENT TIME (MT)

Forward speed of the dominant hand over a distance of 11 inches was measured by means of the apparatus shown in Figure I and recorded by a synchronized chronoscope graduated in .01 second units. The subject was instructed to release a switch (chronoscope start) and strike a target (chronoscope stop) as fast as he could and whenever he was ready. No external stimulus was applied.

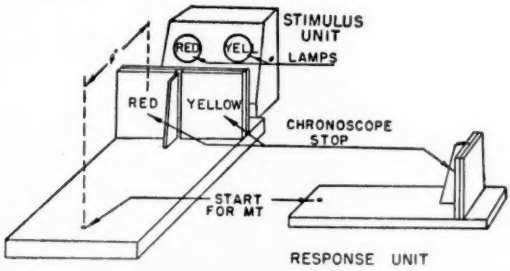

FIGURE I. The Apparatus.

REACTION-TIME MEASURES

For the most part, the system of Donders (1) was used to designate the reaction-time measures. Simple finger-press RT (a-reaction) was measured with the standard telegraph key set to .02 inch. The measurement of discriminatory RT (c-reaction) was made possible by adding to the a-reaction test an alternate stimulus which required no response. Because reaction time is frequently associated with large muscle activity, movement-reaction (m-RT) was considered to be a necessary test item. This was measured by having the subject accomplish MT in response to a stimulus. If instead of a single stimulus and its response, a choice of stimuli and dependent responses are presented, discrimination and choice movement-reaction (b′-reaction) results.

UNKNOWN FACTORS

The subtractive method for determining the speed of single factors in a complex reaction has been generally discredited; complex reaction is not simple reaction with additional items inserted (11, *p. 94*). However, it is not illogical to assume that a discriminary factor, whatever its identity, might result from the subtraction of empirically equivalent items. A time interval

roughly equivalent in duration to a-reaction should result from the subtraction of movement time from the movement-reaction test. The factor or factors determining the duration of this time interval have been designated u-1. U-2 results from the subtraction of m-RT from b'-reaction and u-3 from the subtraction of a-reaction from c-reaction. It was felt that u-2 and u-3 would be equivalent to "discrimination and choice" and "discrimination" respectively.

MCCLOY "BLOCKS TEST"

McCloy (5) devised a test to measure speed in the making of correct choices, complicated partly by motor action and partly by memory of the color sequences. It has been used as an experimental tool for predicting success in baseball (2) and in basketball and football (8) and as such might have some value in fencing.

THURSTONE "S" TEST

A primary mental ability that was isolated in early experiments was that of being able to identify objects in space. In recent years, several space factors have been found and three have been named: S_1, S_2, and S_3 (9). The first of these represents the ability to recognize the identity of an object when it is seen from different angles and it was felt that the "Space" portion of the SRA Primary Mental Abilities Test would measure this ability. It was believed that S_1 might be discriminatory in fencing.

ANTHROPOMETRIC MEASURES

Body measurements of standing height, sitting height, arm span, chest width, and hand width were recorded to the nearest centimeter in accordance with procedures established by Hrdlicka (4). Weight was recorded to the nearest half-pound.

Results

Arithmetic means based on the last 20 of 40 trials were computed for the movement and reaction-time scores (Table 1). Scores for the derived measures (unknown factors) were determined by a subtraction method involving those means. For the "Blocks Test" the score was the time of the faster of two trials. The "S" test and the anthropometric measures were given single recordings.

TABLE 1

Mean Scores of Psychomotor Measures in Seconds

Subject	MT	m-RT	b'-RT	a-RT	c-RT	"Blocks Test"	"S" Test
Fencer	.136	.370	.428	.217	.295	75.95	27.68
Nonfencer	.170	.417	.471	.230	.295	85.93	27.12

The F test was used to determine the homogeneity of variances and the Student small-sample technique to test the hypothesis that differences in population mean scores were non-existent.

THE PSYCHOMOTOR MEASURES

Although the scores of the fencers were more closely grouped about the mean than were those of the nonfencers, only movement and those measures involving movement gave any indication that the differences in mean scores might not be due to chance (Table 2 and Figure III). As reactive factors were added to movement the discriminatory quality became less pronounced. When compared to national norms of the "S" test, both groups scored at the 50th percentile.

ANTHROPOMETRIC MEASURES

Although the data would seem to indicate that nonfencers tend more to the ectomorphic body type than do fencers (Figure II), none of the items measured indicated any difference which could not be attributed to chance.

Analysis of the Data

It was felt that the intercorrelation of certain of the nondiscriminatory measures might yield information pertinent to the study. Because the fencers and nonfencers were in most instances significantly different in variance, it was decided to compute correlation coefficients for each group (Table 3). While there is a significant correlation between movement-reaction and a-reaction times as well as between u-1 and a-reaction, there is none between movement time and a-reaction time. This might be due to the fact that fencers and nonfencers differ most in MT and its subtraction from movement-reaction time leaves a factor or factors very similar to a-reaction.

TABLE 2

Significance of F and t for Psychomotor Scores for Fencers (N = 25) and Nonfencers (N = 25)

	MT	m-RT	b'	a	c	Blks	"S"	u-1	u-2	u-3
F	2.164*	2.514*	3.257**	4.621**	1.495	1.75	3.129**	1.86	2.65*	2.15*
t	3.977**	3.286**	2.754*	1.385	0.008	1.134	0.615	1.19	0.56	1.4

*Significant at the .05 level.
**Significant at the .01 level.

TABLE 3

Intercorrelations of Various Psychomotor, Space Perception, and Anthropometric Measures

Subject	M;a	m-RT;a	u-1;a	Span;a	Span;MT	b';Blocks
Fencer	0.00	0.62*	0.51*	0.06	0.00	0.04
Nonfencer	0.02	0.50*	0.72*	—0.05	—0.11	—0.01

*Significant at the .01 level.

This independence of movement and reaction time substantiates the findings of Henry (3) and Slater-Hammel (7) and may in part account for the conflicting results in "reaction-time" studies which are in effect movement-reaction studies. Choosing tall men for epee and short men for foil, a prac-

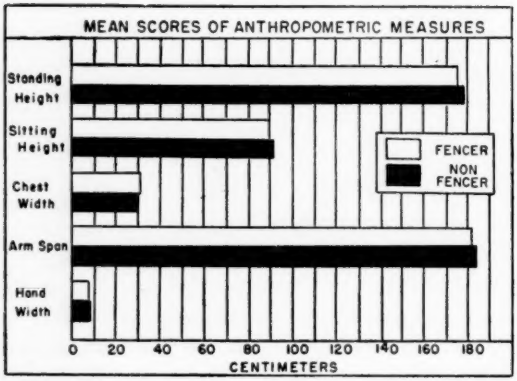

FIGURE II. Mean Scores of Anthropometric Measures.

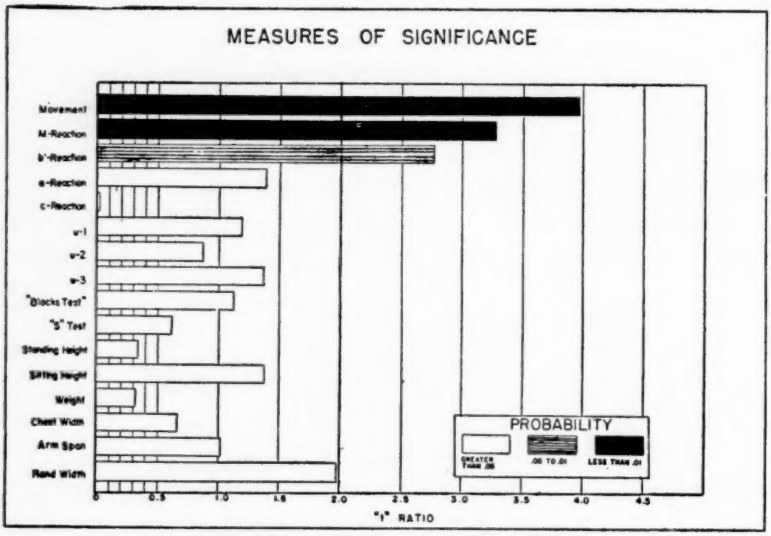

FIGURE III. Measures of Significance.

tice followed by many coaches, appears to be detrimental to their best interests as evidenced by the fact that there is no correlation between speed of arm movement and arm length. Tall men, being nearer to the target than a shorter opponent in foil, have a natural advantage which they lose when placed in epee where each is the same distance from the target.

Summary

Twenty-five fencers and 25 nonfencers were measured under laboratory conditions and a statistical comparison of the data was made. The two groups were compared as to the psychomotor qualities of (1) movement time, (2) movement-reaction time, (3) discrimination and choice movement reaction time, (4) finger-press reaction time, (5) discriminatory RT, (6) three unknown factors derived from the foregoing measures, (7) the McCloy "Blocks Test," (8) the Thurstone "S" Test and the anthropometric measures of (1) standing height, (2) sitting height, (3) weight, (4) arm span, (5) chest width and (6) hand width. Correlations of certain measures which seemed pertinent were made.

Conclusions

On the basis of the statistical analysis of the data, it is possible to draw the following conclusions:

1. Fencers are significantly faster than nonfencers in those measures which involve movement of the arm. These would include movement, movement-reaction, and b′-reaction.
2. Fencers and nonfencers do not differ in discriminatory or simple reaction time when it is measured by the finger-press method.
3. There is no psychomotor measure determined by the subtractive method which would indicate an unknown discriminatory factor. This would tend to discredit the theory of a decrease in perception time through fencing.
4. Fencers are not any more endowed wth "athletic intelligence," as measured by the McCloy "Blocks Test," than are nonfencers.
5. Fencers do not differ from the general population in the primary mental ability S_1 as measured by the "S" portion of the SRA Primary Mental Abilities Test.
6. There are no significant differences in the height, weight, arm span, chest, or hand width of fencers and nonfencers.
7. Neither fencers nor nonfencers demonstrated any correlation between speed of arm movement and reaction time, speed of arm movement and arm length, or reaction time and arm length.
8. The same psychological factors, or different factors having the same speed, operate in u-1 and a-reaction to the same extent.
9. Identical psychological factors do not operate, at least not to the same extent, in the b′-reaction and the McCloy "Blocks Test."

Recommendations

It was not the purpose of this study to determine whether existent differences between fencers and nonfencers were inherent, the outcome of training, or the result of fencing. Further investigations into the area are indicated.

REFERENCES

1. DONDERS, F. C. Die Schnelligkeit psychisher Processe, *Archiv für Anatomie und Physiologie* (1892), 657-681.
2. EVERETT, PETER W., The Prediction of Baseball Ability, *Research Quarterly*, **23**: 15-19 (Mar. 1952).
3. HENRY, FRANKLIN M. Independence of Reaction and Movement Times and Equivalence of Sensory Motivators of Faster Response, *Research Quarterly*, **23**: 43-53 (March 1952).
4. HRDLICKA, ALES. *Practical Anthropometry*. 3d. ed. Philadelphia: Wistar Institute of Anatomy and Biology, 1947. 230 pp.
5. MCCLOY, CHARLES H. 'Blocks Test' of Multiple Response, *Psychometrika*, **7**: 173-179 (Sept. 1940).
6. RARICK, LAWRENCE. An Analysis of the Speed Factor in Simple Athletic Activities, *Research Quarterly*, **8**: 89-105 (Dec. 1937).
7. SLATER-HAMMEL, A. T. Reaction Time and Speed of Movement, *Perceptual and Motor Skills Research Exchange*, **4**: 109-113 (Sept. and Dec. 1952).
8. SMITH, STANLEY M. *The "Blocks Test" as a Measure of Adaptive Athletic Response.* Unpublished Master's Thesis, State University of Iowa, Iowa City, 1943. 22 pp.
9. THURSTONE, L. L. *Some Primary Abilities in Visual Thinking.* University of Chicago Psychometric Laboratory Reports, No. 59. University of Chicago Press, Aug. 1950. 9 pp.
10. WESTERLUND, J. H. and W. W. TUTTLE. Relationship between Running Events in Track and Reaction Time, *Research Quarterly*, **2**: 3, pp. 95-100 (Oct. 1931).
11. WOODWORTH, ROBERT S. *Experimental Psychology.* New York: Henry Holt and Co., 1938. 889 pp.

(Submitted 2/9/55)

Studies of Little League and Middle League Baseball

ELVERA SKUBIC
University of California
Santa Barbara, California

Abstract

This study reports the results of four questionnaires concerning the attitudes of parents and players toward Little League and Middle League competitive baseball, the selection of players for teams, and the extent of injuries received by players during one season of participation in baseball. The results indicated that boys chosen on teams show greater achievement in school subjects, possess greater motor ability and are better adjusted socially and emotionally than boys who are not members of teams. One hundred players reported a total of 244 injuries for one season of baseball. The fingers were injured most frequently by boys in both leagues. The Little League players received the greatest number of injuries while fielding batted and thrown balls, and the Middle Leaguers were injured most frequently while sliding to bases. Boys participating in the program and their parents approved the program wholeheartedly. Their main criticism was that many boys who were members of teams did not get a chance to play in the games.

THE PHENOMENAL growth of Little League Baseball and similar types of competitive activities for boys aged 9 through 15 has raised many questions in the minds of people throughout the country as to the advisability of such programs. In order to answer some of these questions and make recommendations, a typical program in operation was studied.

Purpose

It was the purpose of this study to obtain the attitudes of players and their parents toward Little League and Middle League competitive baseball and to elicit their suggestions for improving the program. Further, an attempt was made to ascertain the extent of injuries sustained by players in one baseball season and also to determine the effects of the program on the daily living habits of players.

Defintion of Terms

Little League Baseball. A national organization which promotes organized baseball for boys between the ages of 8 and 12.

Middle League Baseball. A league which originated in Santa Maria, California, and is designed to organize baseball teams for boys 12 through 15 years of age.

League Players. Any boys who were members of teams in the Santa Maria Little or Middle Leagues during the 1953 baseball season.

Non-players. Boys who were not members of league teams either because they did not choose to try out for a team or did not possess sufficient skills

to be chosen on teams. All boys who volunteered to be in the study were included as subjects.

Procedure

At the close of the 1953 baseball season, four different questionnaires were sent to many people either directly or indirectly involved in the Little League or Middle League programs in Santa Maria, California. A total of 640 questionnaires were sent out to parents, players, and teachers, and 470 replies were received.

Results

PARENTS' QUESTIONNAIRE

Questionnaires were sent to 145 parents of boys who were participating in league baseball during the summer of 1953. Eighty-five of the questionnaires were returned. A simple tabulation of the answers to the questions follows:

Does your boy:

1. usually have as good an appetite on game days as on non-game days?
   Yes—71; No—12
2. have leisure (spare time) interests other than baseball?
   Yes—74; No—10
3. attempt to follow any kind of training program as to sleeping or eating habits?
   Yes—57; No—24
4. seem to attach a great deal of importance to uniforms?
   Yes—42; No—41
   Which seems most important?
   Awards—22
   Uniforms—23
   Spectators—6
5. get quite excited before a game?
   Yes—13; No—35; Sometimes—38
6. have difficulty getting to sleep after a game or just before the day of a game?
   Yes—4; No—61; Sometimes—20
7. stay excited for a long time after his team wins?
   Yes—19; No—60; Sometimes—5
8. become sullen or depressed after his team loses a game?
   Yes—15; No—66; Sometimes—4
9. sometimes become too excited (or depressed) to eat a normal-sized meal?
   Yes—8; No—56; Sometimes—20

Do you:

1. think you would object if your boy were on a team that had to travel to a distant town to play a game?
   Yes—1; No—68; Maybe—16
2. feel that too much time is devoted to baseball and not enough to other activities?
   Yes—8; No—76
3. feel that playing on a team has helped your boy to be a more co-operative member of a group?
   Yes—79; No—4; Perhaps—1
4. feel that the boys become too fatigued with long practices and long games?
   Yes—6; No—58; Sometimes—20

5. find that the late hour of most of the games is a disrupting factor in the home?
   Yes—28; No—57
6. think there should be less emphasis on winning games?
   Yes—18; No—63; Don't know—1
7. believe Little or Middle League Baseball is beneficial to your son?
   Yes—84; No—1
8. Explain as specifically as you can in what ways you think league baseball is good or bad. (The more frequent responses are listed below.)
   (1) Improves sportsmanship—27
   (2) Improves co-operation—24
   (3) Keeps boys from being bored—17
   (4) Improves teamwork and a sense of justice—8
   (5) Learn to win graciously and to accept defeat—8
   (6) A chance to associate with boys from all walks of life—7
   (7) Competition under fair conditions—5
   (8) Good health (fresh air and sunshine)—5
   (9) Become better citizens—4
   (10) A chance to meet people—4
   (11) Develop physically and mentally—4
   (12) Character building—4
   (13) Learn better baseball—4
   (14) Energy release—3
   (15) Less street wandering—3
   (16) Learn respect for elders—2
   (17) Better father-son relationships—2
   (18) Brings the whole family closer together—2
9. How can the leagues be improved to provide better experiences for the boys?
   (1) Each boy should have a chance to play in each game—10
   (2) Get good managers who know how to handle boys—6
   (3) Eliminate parental interference in games—8
   (4) Have more teams so more boys get to play—5
   (5) Need better officials and leaders—6
   (6) Have less cliques. Choose teams from wider area—3
   (7) Need more evenly matched teams—2
   (8) Eight year olds should not have to compete with 13 year olds in the same league—2
   (9) Change time of games. Late games interrupt dinner schedule—2
   (10) More praise and less heckling from spectators—2

One-third of the parents said their sons were too excited after winning a game or too depressed after losing a game to eat a normal-sized meal. In some cases, the excitement after a game not only lasted long enough to interfere with the boys' appetites, but also interferred with their ability to get to sleep.

It should be noted that the majority of boys were apparently not overly excited before or after a game and their appetites or sleep not disturbed in any way. However, if people are concerned with all boys, they should be concerned about the small group of boys who were affected adversely. If a boy becomes overly excited to the extent that both his appetite and his habits of sleep are disturbed, this could be detrimental of his general health, especially

if maintained throughout a five-month baseball season. D. A. Prescott has stated that,

> In all cases of strong emotions the psychological reactions which occur last longer than in the cases of mild emotions. These effects are much more drastic and dramatic, and the crisis interferes with some of the normal visceral functions, notably with digestion, assimilation and elimination. These emotions are all detrimental to health if experienced too frequently or continuously (12).

While most parents believed that league baseball was a positive factor in their son's development, they offered many suggestions for improving the leagues. The most frequently mentioned suggestions were: (1) to give every boy on a team a chance to play at least a short while in every game, (2) to recruit managers, officials, and other leaders who know how to handle young boys and (3) to eliminate parental interference in games.

As would be expected of parents whose boys were given permission to participate in league competition, they gave almost unanimous approval to the baseball program in Santa Maria, California.

PLAYERS' QUESTIONNAIRE

This questionnaire was sent to all Little League and Middle League players during the 1953 season. Of the 145 questionnaires sent out, 97 answers were received. The questions were phrased as simply as possible because of the broad diversity of home and nationality backgrounds and ages of the group. The tabulation of the answers to the questions follows:

1. What is your favorite sport, activity or hobby?
   Baseball—69
   Football—16
   Basketball—4
   All sports—4
   Archery—1
   Stamp collecting—1
   Swimming—1
2. What sports besides baseball do you participate in during the year?
   Basketball—71
   Football—70
   Track—18
   Swimming—17
   Tennis—7
   Fishing—6
   Hunting—5
   Golf—4
   Horseshoes—2
   Boxing—2
   Volleyball—1
   None—4
3. How much of your spare time is spent on baseball or softball during the entire year?
   Most of it—21; Half—60; Small part of it—15

4. How do you feel when you don't get a chance to play in the game?
   Feel very bad—32
   It gives others a chance to play—14
   Don't feel any different—12
   Always play—12
   Want to play more than ever—5
   Not so good—5
   Take it for granted that I can't play all the time—2
   Hope I can get in the next game—1
   Feel forgotten—1
   Should do better in practice—1
   Feel like a failure—1
   Have a let-down feeling—1
5. Is your appetite as good on the days you have a game as it is on non-game days?
   Yes—86
   No—10
6. Does winning or losing a game make any difference in your appetite? If so, tell in what way.
   Yes—12
   No—86
   How?
   Feel sick if we lose a game—2
   Feel mad if we lose and then feel less hungry—2
   Downhearted if we lose—can't eat—1
   More hungry if we win—1
   Eat less if we lose—6
7. When your team loses, are you very disappointed, slightly disappointed or not disappointed at all?
   Very disappointed—37
   Slightly disappointed—51
   Not disappointed at all—7
8. Do you often stay awake for a long time after you have gone to bed and think about the game played that day or the one to be played the next day?
   Yes—16
   Sometimes—42
   No—39
9. Does winning a game mean a great deal to you?
   Yes—83
   No—12
10. Would you care to play on a league team even if there were no uniforms of any kind?
    Yes—94
    No—3
11. Would you like to be able to play in the major leagues some day?
    Yes—92
    No—3
    Don't know—1
12. Usually, how long before a game do you begin to get excited about it?
    More than five hours—6
    Four hours before the game—1
    Three hours—6
    Two hours—6
    One hour—7

Half hour—11
Just before the game—56

13. Are you more nervous when there are many spectators watching you play than when there are not so many?
Yes—16
No—79

14. How long do you usually stay keyed up and excited after you finish a game?
30 minutes—56
One hour—20
Two hours—8
Three hours—2
More than 3 hours—6
None—1

15. Do you feel very bad when you have played a poor game?
Yes—75
No—19

16. Do you usually feel very tired after you finish a game?
Yes—9
No—30
Sometimes—56

17. What things do you especially like about league baseball?
(1) A chance to get acquainted with other boys—29
(2) It is fun to play on a league team—29
(3) Keeps me out of mischief—14
(4) Teaches sportsmanship—13
(5) Improves playing—12
(6) Like competition—9
(7) A chance to be on an organized team and have managers—7
(8) Learn to play with boys of all kinds—6
(9) Learn teamwork—6
(10) Good coaches and managers—10
(11) Can have good equipment—7
(12) Like to take trips—5

18. What things do you dislike about league baseball?
(1) Bad umpiring—8
(2) When I don't get a chance to play in the game—8
(3) Every player should get a chance to play at least two innings in every game—3
(4) Parents who nag—2
(5) Coaches and spectators who are poor sports—2
(6) Everyone who wants to play doesn't make a team—2
(7) The time games are played is bad—2
(8) Not enough teams in the league—4

Eighty-one players reported that from half to most of their leisure time during the whole year is spent on baseball. The specialization required by highly organized programs does not seem in keeping with the recognized need for variety of experience in recreational activities. In a recent survey by J. B. Nash, prominent physical educator, it was found that the recreational skills of most adults are those acquired at an early age (5). Therefore, it seems important that youngsters learn many activities during this period in which their recreational habits are being established.

The subjective judgment of the boys as to their emotional state on the day of a game was interesting. In anticipation of a game to be played, 37 boys began to be excited from a half hour to over five hours before the start of the game. Fifty-six said they do not begin to get excited until just before the game is ready to start. Both Bishop (1) and Johnson (7) in their studies of college athletes found that athletes were in a state of excitement hours and sometimes days before an intercollegiate contest and many were unable to sleep and rest properly due to the state of tension of the muscles. In the present study, the majority of boys reported that sleep was disturbed because of game situations.

Some boys, and their parents, too, seemed to be quite upset by the fact that many players do not receive a chance to play in the games. Half of the boys in the study said they feel bad when they do not get in the game. Psychologically, this could have far-reaching effects. When a boy gets into his uniform and reports for a game, he has a preparatory set for activity which is not satisfied. As Symonds has written,

> This preparatory set may be in part muscular, but probably also in large part, it is psychologically what has sometimes been called emotional tension. . . . The action of the sympathetic nervous system has prepared the individual for vigorous and decisive activity. . . . This emotional tension may persist for a considerable interval in case there is no immediate muscular discharge. In fact, an emotional tension in the form of anxiety can become, in a degree, chronic, indicating the inhibition of immediate discharge and satisfaction of the drive (15).

A boy has psychological as well as physiological characteristics and, therefore, any factors which affect his emotional life will inevitably affect his entire physical state. It is difficult to say how deeply disturbed the boys were who rarely, if ever, participated in a game. Perhaps provisions can be made in the rules which will give every boy an opportunity to play a part of every game.

Undoubtedly, the boys benefited in many ways from their experiences on Little League and Middle League teams. According to their reports, they felt they gained most by having an opportunity to meet other boys in the community. They also felt it was a good experience because it kept them out of mischief, it was fun, and it taught good sportsmanship.

INJURY QUESTIONNAIRE

Questionnaires were sent to all of the Little League and Middle League players. Of the 140 questionnaires sent out, 100 were returned. The boys were asked to check the part of the body injured during the 1953 season, the number of times each part was injured, in what type of situation it occurred, the number of days missed playing ball owing to the injury, and to list the injuries that were still troublesome.

There were a total of 244 injuries reported. Of this number, there were 146 bruises and 24 cuts, most of which were classified as relatively minor injuries. The more serious ones included 69 sprains and 5 broken bones.

Twenty-seven boys reported not having been injured at any time during the season. Table 1 shows the number and type of injury to each part of the body for 100 boys.

TABLE 1

Number and Type of Injuries to Each Part of the Body (100 Subjects)

Part Injured	No.	Sprain	Bruise	Break	Cut
Finger	46	32	11	0	3
Arm	29	6	19	0	4
Upper leg	24	2	18	0	4
Head	19	0	19	0	0
Lower leg	19	2	14	0	3
Ankle	18	12	5	0	1
Back	17	4	13	0	0
Shoulder	16	1	15	0	0
Hip	11	2	4	3	2
Knee	11	3	6	1	1
Foot	9	1	6	0	2
Face	6	0	3	0	3
Stomach	5	0	5	0	0
Chest	4	0	4	0	0
Toe	4	0	2	1	1
Wrist	4	4	0	0	0
Elbow	1	0	1	0	0
Hand	1	0	1	0	0
Total	244	69	146	5	24

For the 60 Little Leaguers who responded to the questionnaire, there were 123 injuries, with 19 boys claiming no injuries. The 40 Middle Leaguers who returned questionnaires reported a total of 121 injuries.

Table 2 compares both leagues in the number of injuries incurred to specific parts of the body. The highest incidence of injuries for both leagues involved the fingers. The Little League players had a significantly greater number of finger and arm injuries than the Middle League players, probably because of lack of skill in handling a hard ball.

On the other hand, the Middle League players had a significantly greater number of injuries to the wrists, hips, feet, toes, and ankles, probably because these boys wore cleats on their shoes and were encouraged to slide to bases.

Table 3 shows the game situation in which the injuries occurred. The greatest incidence of injuries for the Little League players (38% of the total) occurred while the boys were fielding thrown or batted balls. The next highest incidence of injuries (27%), occurred when the batters were hit by pitched balls. Ordinarily, boys of this age do not have good control of the ball and it is probably reasonable to expect frequent injuries to batters. Another factor that might have been instrumental in causing injuries to batters was the short pitching distance (44 ft.), which hardly allowed the batter with somewhat slow reflexes to step out of the way of a fast, wild pitch. Further investigation is needed to determine if this pitching distance is short relative to the speed of balls thrown by pitchers of this age group.

For Middle League players, the greatest number of injuries (31%) occurred sliding to bases and when batters were hit by pitched balls (31%). Metal spikes were worn on the shoes and this accounted for many of the accidents. Also, many of the younger boys in this league were still not very proficient in the technique of sliding to bases, and this might easily account for the high incidence of injuries to the hips, legs, and ankles.

The boys were asked to report only those injuries to the head in which the head protector was ineffective. Insofar as could be discerned, none of the head injuries reported were serious ones and, undoubtedly, the helmet protected the head against serious injury.

Fifteen boys reported having an injury which still bothers them in some way. The injury might have occurred anytime from five to nine months previous to the report. There is no way of knowing at this time whether or not any of the injuries will prove troublesome to the boys later in life. Longitudinal-type studies are needed to determine the after effects of injuries that occur early in life.

TEACHERS' QUESTIONNAIRE

In order to gain more insight into the type of boys who are chosen on teams and those who are not, the teacher of every league player and nonplayer involved in the study was asked to rate each boy on his achievement in general school subjects, his skill in physical education classes, and his social-emotional adjustment in school. The letter that accompanied this rating sheet explained the meaning of each category and the method of rating.

TABLE 2

Injuries to Specific Parts of the Body—Little League and Middle League Players

Injury	Little League			Middle League			Analysis		
	No.	%	σ	No.	%	σ	σ/d	C.R.	P
Finger	29	23.5	3.7	17	14.0	2.6	4.4	2.15	.05
Arm	19	15.4	3.1	10	8.2	2.2	3.74	1.93	.10
Head	12	9.7	2.6	7	5.7	1.7	9.8	.41	Less than .05
Upper leg	11	8.9	2.5	13	10.7	2.4	3.4	.53	Less than .05
Back	10	8.1	2.4	7	5.7	1.7	2.9	.83	Less than .05
Lower leg	10	8.1	2.4	9	7.4	1.4	2.7	.26	Less than .05
Shoulder	10	8.1	2.4	6	4.9	1.7	2.8	1.14	Less than .05
Ankle	5	4.0	1.7	13	10.7	2.4	2.8	2.39	.02
Knee	5	4.0	1.7	6	4.9	1.7	2.3	.39	Less than .05
Face	4	3.2	1.4	2	1.6	1.0	1.7	.90	Less than .05
Chest	3	2.4	1.9	1	.8	2.2	2.8	.57	Less than .05
Stomach	3	2.4	1.9	2	1.6	1.0	2.1	.38	Less than .05
Foot	2	1.6	1.0	7	5.7	1.7	1.8	2.27	.05
Elbow	0	0	0	1	.8	6.7	6.7	.10	Less than .05
Hand	0	0	0	1	.8	6.7	6.7	.10	Less than .05
Hip	0	0	0	11	9.2	2.2	2.1	4.38	.01
Toe	0	0	0	4	3.3	1.4	1.2	2.75	.01
Wrist	0	0	0	4	3.3	1.4	1.4	2.35	Less than .05
Total	123 2.1 injuries per boy			121 3.0 injuries per boy					
No injuries	19			3					

TABLE 3
Number of Injuries Which Occurred in Specific Game Situations

Situation	Total		Little League		Middle League	
	No.	%	No.	%	No.	%
Hit by pitched ball	72	30	34	28	38	31
Hurt fielding a ball	68	28	47	38	21	17
Sliding to base	41	17	4	3	37	31
Injured in catcher position	25	10	24	20	1	1
Hurt while running	9	4	6	5	3	2
Hurt throwing a ball	8	3	4	3	4	3
Ran into another player	8	3	1	1	7	6
Spiked	7	3	0	0	7	6
Hit by a bat	4	2	1	1	1	1
Hurt while batting	2	1	1	1	1	1
Total	244		123		121	

The evaluation of each boy on his achievement in school subjects was made to determine what kind of student he is in academic courses. The evaluation of the boy's achievement in physical education was based primarily on the grades he generally achieved in this subject in school. The social-emotional rating was meant to indicate such things as how well the boy gets along with his classmates, his emotional stability, and the like.

Of the 210 questionnaires sent out to teachers, ratings were returned for 188 boys—94 players and 94 non-players. Table 4 presents the tabulation of results which compares the ratings of the players of both leagues with the ratings of the non-players.

In the rating on general subjects, the players were significantly higher than the non-players on the above-average rating, indicating that the players do better work in school. It is possible that players receive better grades in school because they apply themselves better or because they are more intelligent than non-players. In either case, all other things being equal, a coach would most likely choose a boy for a team who worked diligently, understood rules of the game, and played an intelligent game rather than one who did not.

As might be expected, the players were significantly higher than the non-players on the excellent and above-average ratings for physical education skills. Also, the non-players were significantly lower in the average and below-average ratings in physical education skills.

The evaluation of the boys' social-emotional adjustment showed that there was no significant difference between non-players and players. However, there were a significantly greater number of non-players who were rated as more poorly adjusted than members of teams.

It appears that the boys who display the best baseball techniques, play the most intelligent game, have emotional stability, and get along best in a group are the ones who are chosen to play competitive baseball.

TABLE 4

Teacher Evaluation of Academic, Skill and Emotional Status of Players and Non-Players

Item	Achievement in General Subjects				Skill in Physical Education				Emotional Adjustment			
	Excellent	Above Average	Average	Poor	Excellent	Above Average	Average	Below Average	Very Well Adjusted	Well Adjusted	Not Well Adjusted	Poorly Adjusted
Players												
Number	11	27	43	13	24	33	37	0	18	67	8	1
Per cent	11.7	28.7	45.7	13.8	25.5	35.1	39.4	0	19.1	71.3	8.5	1.0
σ	3.3	4.5	4.6	3.4	4.4	4.8	5.0	0	4.0	4.6	2.8	.1
Non-players												
Number	5	17	52	20	4	20	56	14	11	63	14	6
Per cent	5.3	18	55.2	21.0	4.6	21.2	59.5	14.9	11.7	66	14.9	6.3
σ	2.2	3.8	5.0	4.1	5.0	4.1	5.0	3.6	3.3	4.8	3.6	2.4
σ/d	3.97	5.89	6.79	5.33	6.66	6.99	7.07	3.60	5.19	6.65	4.56	2.40
Critical ratio	1.61	1.81	1.40	1.35	3.14	2.00	2.84	4.13	1.42	.79	1.40	2.25
Significance	—	.10	—	—	.01	.05	.01	.01	—	—	—	.05

Conclusions and Recommendations

At the close of the 1953 baseball season, a series of questionnaires were sent to people who were directly or indirectly concerned with the Little League and Middle League baseball program in Santa Maria, California. It was the purpose of the study (1) to determine the attitudes of players and their parents toward competitive baseball, (2) to find out in what ways the program affects the daily lives of boys, (3) to gain further insight into the selection of players, and (4) to determine the extent and type of injuries players received in one season of play.

As would be expected, parents approved wholeheartedly of Little League and Middle League baseball for their sons and felt that these programs were positive factors in contributing to their sons' development.

Questionnaires were sent to players and their parents which were concerned mainly with the affect of competition on the health and welfare of the players. Although some of the boys apparently were affected adversely, the majority of boys were not.

A separate checklist of injuries was answered by 100 players and they reported a total of 244 injuries for one season of baseball. Although the majority of injuries were relatively minor ones, at least 74 (involving sprains and breaks) were considered serious injuries. The players injured their fingers more often than any other part of the body.

The results of the questionnaire sent to teachers of players and non-players indicated that the boys on teams are highly selected and possess more physical skill, receive better grades in school, and are emotionally better adjusted than boys who do not play on league teams.

The following recommendations are based on some of the findings:

1. Many players and their parents were disturbed because some boys were not given a chance to play in games even though they came out regularly for practices. A change in the rules could be made which would allow every boy on a team to play at least a short time in every game. This could be done in such a way as to be fair to all teams.

2. There seemed to be a general feeling on the part of parents and players that those in charge of the program should be more selective in the recruitment of officials, managers, and coaches. Perhaps an attempt should be made to offer a training program for these leaders which would better enable them to work effectively with young boys.

3. It was found that the majority of boys in the study devoted from half to most of their leisure time throughout the year to baseball. The 9-to-12-year age is an age of exploration, and organized effort toward specialization in one skill is educationally unsound. Perhaps a shorter training season, shorter tournament schedule, and encouragement from coaches to participate in a variety of activities would be helpful.

4. Sleeping and eating habits of many of the boys were disturbed due

to the excitement of the games. Less emphasis on winning, fewer spectators, less pressure from parents, and less publicity would probably result in less tension for these boys.

5. The 8-to-12-year-old boys injured their fingers more often than any other part of their bodies. A program of softball rather than baseball should be considered for this age group.

6. No serious injuries to the head were reported in either league which suggests the continued use of the helmet for batters.

7. In both leagues, the players at bat received a large proportion of the total number of injuries. Some experimentation is needed to study the relationships of the pitching distance, the rate of speed of pitched balls, and the frequency of injury.

8. The largest proportion of injuries in Middle League—to the hips and legs—occurred when runners slid into bases. This suggests more individual coaching for this age group in the technique of sliding.

REFERENCES

1. Bishop, Austin. *The Correlation of Blood Counts, Body Temperature, and Pulse Rate with Emotional States,* Unpublished Doctoral dissertation, New York University, 1942.
2. Butts, Bevier. Little League—Yes or No? *Illinois Recreation Association Bulletin,* No. 31, Waukegan, Ill., 1953.
3. Castle, Ames. Teamwork—The Case For and Against Small Fry Tournaments, *Industrial Sports Journal,* **13:** 25-26 (Feb. 1952).
4. ———, What Oakland Parents Say About Little League Ball, *Industrial Sports Journal,* **13:** 13 (May 15, 1952).
5. *Children in Focus,* Yearbook of the American Association for Health, Physical Education and Recreation, Washington, D. C., 1954.
6. Holman, Edward. A Study of Little League Baseball in Operation—1951, Recreation Director, City Hall, Fresno, California.
7. Johnson, Warren. Emotional Upset in Athletes, *Athletic Journal,* **32:** 7-10 (Nov. 1951).
8. ———, A Study of Emotion Revealed in Two Types of Athletic Contests, *Research Quarterly,* **20:** 72-79, 1949.
9. Lowman, C. L. Children's Sports? *California Parent Teacher,* **28:** 10 (Sept. 1951).
10. ———, The Vulnerable Age, *Journal of the American Association for Health, Physical Education and Recreation,* **18:** 635-636 (Nov. 1947).
11. Montgomery, Katherine. A Giant Controversy Over Midget Sports, Director of Physical Education, Florida State College, Tallahassee.
12. Prescott, D. A. *Emotions and the Educative Process,* Washington, D. C.: American Council on Education, 1938.
13. Scott, Phoebe. Attitudes Toward Athletic Competition in the Elementary School, *Research Quarterly,* **24:** 352-361 (Oct. 1953).
14. Solomon, Ben. Little League—Menace or Blessing? *Youth Leaders Digest,* **15:** 161-213 (Feb. 1953).
15. Symonds, Percival. *Dynamic Psychology,* New York: Appleton-Century-Crofts Co., 1949.
16. Young, Paul T. *Emotion in Man and Animal,* New York: John Wiley and Sons, Inc., 1943.

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Metabolic Cost of Simulated Sled Pulling on the Treadmill

JAN H. VANDERBIE
QM R&D Command
Natick, Massachusetts

Abstract

This study presents the metabolic rates and pulse responses to an exercise of a dual nature, i.e., pulling against a drag of 17.5 pounds, while walking on a treadmill. The study was initiated to estimate the severity of sled pulling activities. Findings indicate that a relatively small posterior pull can raise the metabolic rate to very high levels. The application of this principle could be useful in designed experiments, where it is desired to have several subjects exercise simultaneously on the treadmill and to have different levels of heat production, over and above the level produced by body weight alone.

HUMAN LOAD-carrying or "man-hauling" may be accomplished by carrying, pushing, or pulling. These activities still constitute a part of several occupations and sports. Little information is available concerning physiological changes in the body produced by various forms of load carrying. In ski areas, members of the ski patrols must be prepared to use sleds or toboggans to evacuate casualties. Sled-pulling is an activity common to soldiers stationed in arctic or sub-arctic environments. The fitness of men to perform activities such as sled-pulling cannot be adequately determined unless it is known what stresses are actually imposed. In order to provide some preliminary answers to these questions, a laboratory investigation of metabolic cost and pulse rates associated with walking while a rearward pull is exerted, has been carried out.

General Plan and Methods

A series of experiments were performed during control periods, before and after the test subjects went to Fort Churchill, Canada, in the winter of 1951-52. Measurements of energy cost and pulse rates were made in the morning at least 1½ hours after breakfast. The subjects, army enlisted men, were dressed in cotton fatigue uniforms and leather combat boots. The temperature in the test room was controlled at 70° ±2° F. The humidity control was set at 40 per cent relative humidity. Although humidity was not measured, it can be assumed that humidity did not materially change during the experiment.

The exercise consisted of walking on a horizontal, motor-driven treadmill at 2.5 and 3.5 mph, while pulling a weight. This weight was hung over a pulley and attached to the body with a rope and a body harness. The harness had straps three inches wide, which encircled the shoulders and the waist. The angle of pull was 20°-25° above the horizontal. During exercise, the pull

recorded from 10-26 pounds, as measured with a spring scale. The static pull was 17.5 pounds.

Metabolic rates were measured with a Tissot Spirometer, operating as a closed system. The caloric expenditure was computed from the total oxygen consumption by assuming an R. Q. of .82 and a caloric equivalent of 4.8 calories per 1000 cc. of oxygen. At frequent intervals the energy cost of each subject was measured from start to 5 minutes after the exercise. In all instances was a steady state reached after 15 minutes. The figures presented in this paper are based on the oxygen consumptions measured during the last 8 minutes of the 30 minute trials, uncorrected for oxygen debt.

Pulse rates were obtained by wrist palpation during the final minute of the exercise.

A total of 12 men were studied. The characteristics of these subjects are given in Table 1.

TABLE 1

Characteristics of Test Subjects

Item	Age in Years	Weight in Pounds	Height in cm.	Surface Area in Sq. Meters
Mean N = 12	22.8	149	171	1.78
Range	20-30	112-199	164-183	1.54-2.15

Results

The metabolic rates, obtained before the men went to Fort Churchill, are given in Table 2. In order to facilitate comparison with the results of field studies, published elsewhere (1), the metabolic rates are also presented expressed as Calories/M^2/per distance traveled. The metabolic cost of sled-pulling with a drag of 17.5 pounds and at a speed of 2.5 mph averaged 267 Cal/M^2/hr. It is of the order of magnitude of such activities as walking at 3.5 mph up a 7.5 per cent slope, or running at a speed of 5 mph (2). It is higher than the cost of carrying loads of 80 pounds, which was previously observed to average 240 Cal/M^2/hr. (3).

The average pulse rates for walking at 3½ mph with no load, walking at 3.5 mph with a 44-pound load, and simulated sled-pulling at 2.5 mph were respectively 113, 124, and 136 beats per minute. A pulse rate of 136 beats per min. is indicative of heavy work. Forbes (2) states that exercise causing a pulse of 125 beats per minute, involving approximately 1290 ft lbs/M^2/min can be maintained for 5 hours. External work at the rate of 2500 ft lbs/M^2/min, causing a pulse rate of 150 beats per min can be continued for only 2 hours. Simulated sled-pulling involves external work at the rate of about 2100 ft lbs/M^2/min, and it is estimated that this activity could be

TABLE 2

Metabolic Cost of Exercise for Walking, Walking with a 44-Pound Backload and Sled-Pulling[1]

	Walking No Load 3½ mph	Walking 44 lbs. Load 3½ mph	Simulated Sled Pulling 2½ mph
	CAL/M²/hr.		
Mean N = 12	181.5	214.0	267.5
S.D.	11.5	9.9	16.0
	CAL/M²/200 Yards		
Mean N = 12	5.89	6.95	12.16
S.D.	.37	.32	.73

[1]Figures in this table represent the average of 3-4 trials.

maintained for 3-3.5 hours at the most, based on consideration of energy output and not on local muscle fatigue.

Group averages for weight loss (sweat loss) obtained by weighing the subjects nude before and after exercise, were:

Walking at 3½ mph No Load	Walking at 3½ mph 44 lb Load	Simulated Sled pulling 2½ mph
284 grams per hour	459 grams per hour	460 grams per hour

Local muscle strain during pulling was subjectively evident, principally in the extensor groups of the legs. Considerable improvement, as evident from remarks made by the subjects, took place with training.

The metabolic rate studies were repeated in March 1952 when the subjects had returned from Fort Churchill. In addition to the 2.5-mph speed, previously used, studies were conducted at a belt speed of 3.5 mph. To test the effect of arctic clothing in increasing energy expenditure, five men also pulled the simulated sled at 3.5 mph in the cold room, while wearing arctic uniforms. Table 3 summarizes the results of these measurements. The increase in energy cost owing to wearing arctic uniforms was 9 per cent. This figure is lower than those given by Forbes (2). He states that the metabolic rate is raised about 10 per cent owing to the "hobbling" effect and another 10 per cent owing to the increased weight of arctic clothing.

The values of metabolic rates of simulated sled-pulling at 2.5 mph before and after the men went to the sub-arctic averaged 268 and 245 Cal/M²/hr

TABLE 3

Metabolic Cost in CAL/M²/hr. of Simulated Sled-Pulling at 2½ mph and 3½ mph While Wearing Fatigue Uniforms and at 3½ mph While Wearing Arctic Uniforms[1]

Item	In Cotton Fatigue Uniform		In Arctic Uniform
	2½ mph	3½ mph	3½ mph
Mean N = 5	245	336	366
S.D.	19.1	33.5	45.2

[1]The figures in this table are the average of 3 trials.

respectively. The efficiency increased 6.8 per cent, which is statistically significant at the 5-per-cent level of confidence. The walking efficiencies did not change after Fort Churchill.

Increasing the speed of simulated sled-pulling on the treadmill from 2.5 to 3.5 mph resulted in a proportionate increase of the metabolic cost. From this small comparison, it does not seem that speed affects the pulling efficiency, under the conditions tested.

Discussion

The high energy cost and physiological strain of pulling against a rearward drag of 17.5 pounds is not surprising in view of the leverages involved. The body must be rocked forward against resistance from a fulcrum at the ankle. Since this is an exercise to which most subjects are not accustomed, considerable improvement in efficiency will take place with training.

The question may be raised whether the pressure exerted by the harness in pulling alters the respiratory and pulse response of the subject. Forbes and Whittenberger (4) present evidence that the pressures resulting from a posterior pull of 15.4 pounds did not embarrass respiration nor materially alter the pulse response, when compared to exercise involving an equal amount of external work consisting of walking upgrade on a treadmill.

The finding of a marked increase in energy expenditures and physiologic strain with a relatively small posterior pull may have applications in experiments where it would be desirable to produce several levels of energy expenditure with the same and different activities. The use of posterior pull permits change of metabolic rate in a series of subjects without requiring changes in treadmill speed. Thus, it may become possible to make simultaneous observation on 2-4 subjects on one treadmill, each working at a different level of energy expenditure over and above the individual level produced by body weight alone. This principle may be especially useful in clothing tests.

In contrast to the strain caused by a heavy backload, the person pulling the sled is not constantly subject to the drag. There are moments when, due

to the inertia of the moving weight, or sled, one can obtain more or less rhythmic relief and these moments seem to be sufficient to prevent excessive accumulation of local strains. In comparison with carrying an 80-pound backload at 3.5 mph, simulated sled pulling at 2.5 mph requires more energy. It is believed, however, that the exercise of simulated sled pulling can be tolerated for much longer a time than carrying an 80-pound load.

The pull and energy expenditure required for actual sled-pulling under subarctic conditions at Fort Churchill has been reported by Vaughan (1). From his regression formulae, the predicted value for a mean drag of 17.5 pounds is 17.0 Cal/M^2/200 yards. The mean value for a drag of 17.5 pounds in the treadmill study was 12.1 Cal/M^2/200 yards. Simulated sled-pulling differs in at least one very important point from real sled-pulling. On the treadmill, the subjects walk over a smooth, non-skid rubber surface. In the field, factors such as snow-depth, breakable crust, skids, and uneven walking surface are certainly responsible for part of the higher metabolic rates.

One of the factors that contribute to higher energy expenditures under field or natural conditions has been studied independently (5). In previous experiments it has been found that walking with a load on a treadmill required 9-10 per cent less energy than carrying the same load on an asphalt road. It is possible that the same factors that are responsible for the lower energy expenditure while carrying a load on a treadmill are also responsible for some of the discrepancy between sled-pulling on the treadmill and in the field.

Christensen and Högberg (6) conducted a series of measurements to study the physiologic effects of skiing under various conditions. In one experiment they measured the metabolic rate of skiers pulling a 66-pound load on a little sled or pulka. On a level course, and at a speed of 2.5-3.0 mph the metabolic rate wase approximately 475 Cal/M^2/hr, which is 65-90 per cent higher than when the subjects skied with no sled. When the 66-pound load was carried on the back, the metabolic rate increased 26-40 per cent over the no-load values of the skiers. Again, it appears that a relatively small posterior pull can cause a very marked increase in energy cost. Since skiing, even at relatively low speeds, requires a very high level of energy expenditure, the added energy cost of pulling sleds, etc., should be considered in the training program of those that may engage in these activities.

Summary

Application of a posterior pull by means of harness, rope, pulley, and weight is a convenient means for causing a marked increase in energy expenditure while walking on a treadmill. The possible application of this procedure in designed experiments and clothing tests has been discussed. Sled-pulling on the treadmill also seems to be an activity well suited to the progressive conditioning of subjects to high rates of energy output.

The metabolic rates and pulse rates indicate that sled-pulling can be classified as very hard work. At a speed of 2.5 mph, the group average was 267.5 Cal/M^2/hr, which is higher than the metabolic rates for carrying an 80-pound backload at 3.5 mph. The pulse rates averaged 136 beats per minute, which compares with pulse rates obtained while subjects carried a 65-pound backload at 3.5 mph. The energy expenditure for silmulated sled-pulling, in arctic uniform and at a speed of 3.5 mph is 366 Cal/M^2/hr, which is about 29 per cent lower than figures obtained in the field (Fort Churchill), for the same mean drag. This discrepancy can be attributed, at least partly, to the added difficulties of walking over uneven and slippery snow surfaces and breakable crusts when compared to walking over the smooth, non-skid surface of the treadmill belt.

REFERENCES

1. Vaughan, J. A. and F. Daniels. The Energy Cost of Sled Pulling. *Physiology of Load Carrying IX. E.P.D. Report,* OQMG (to be published).
2. Forbes, W. H. Definitions, Miscellaneous Figures and Conversion Factors, *Physiology of Heat Regulation,* L. H. Newburgh, ed. Philadelphia: W. B. Saunders Co., 1949.
3. Daniels, F., J. H. Vanderbie, and C. L. Bommarito. Energy Cost of Carrying Three Load Distributions on the Treadmill. *Physiology of Load Carrying I. E.P.D. Report No. 203,* OQMG, Mar. 1953.
4. Forbes, W. H., and J. L. Whittenberger. The Effect of Pressure Applied to the Chest on Respiratory Mechanics. *Physiology of Load Carrying VIII. E.P.D. Report,* OQMG (to be published).
5. Daniels, F., J. H. Vanderbie, and F. R. Winsmann. The Energy Cost of Treadmill Walking Compared to Road Walking. *Physiology of Load Carrying VI. E.P.D. Report No. 220,* OQMG, Aug. 1953.
6. Christensen, E. H., and P. Högberg. Physiology of Skiing. *Arbeits Physiologie,* **14:** 292-303, 1950.

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Notes & Comments

NOTES

Undergraduate Requirements in Anatomy and Physiology for Physical Education Majors in Eighty-three Colleges and Universities

DELMAR I. ALLMAN
Oregon State College
Corvallis, Oregon

THE PURPOSE OF this study was to determine the undergraduate requirements in anatomy, kinesiology, physiology, and physiology of exercise, by colleges and universities having major curricula in physical education.

In order to get a wide cross-sectional representation, 96 institutions of higher learning were selected from 43 states and the District of Columbia. All but three of these were coeducational. In 32 of these colleges the directors of physical education were interviewed personally to get the desired information. These 32 colleges were located in 13 western and middle-western states. A questionnaire was used to secure the information from the other colleges, as time would not permit a personal interview with all the directors. Of the 96 institutions contacted, information was secured from 83 of them, representing 86.4% participation.

The average enrollment of the colleges in the study was 7,241 students. Only five colleges had enrollments under 2,000 students, and the highest enrollment was 22,000. Sixteen colleges had enrollments of over 10,000 students each, with only eight of them having 15,000 or over. Forty-seven of them had enrollments less than the average, while 36 had enrollments more than the average.

As only 19 colleges are on the term or quarter basis, and 64 are on the semester plan, the total term hours are transposed to semester hours for the purpose of a comparison of the offerings: (T.H. = 2/3 of S.H.). The average number of semester hours required in this field is 10+. Of the 44 colleges requiring *more* than the average 10 semester hours of total work, 19 are above the average enrollmnt and 25 are below the average enrollment.

Of the 49 colleges having dissection work in anatomy, 23 utilize the human cadaver. Only *seven* of these have the students do the dissecting, the others using demonstrations by the instructor. Several teachers who use this latter method expressed the belief that there is not much value in this kind of dissection work, as many of the students can not see the demonstrations clearly. Of the seven colleges having the students do the dissecting of the human cadaver, four are above the average enrollment, with three of these having enrollments of over 10,000 students each. Of the 23 colleges making use of the human cadaver, 15 are above the average enrollment.

Five colleges include kinesiology in the anatomy course, and four others include it with the course in physiology of exercise. Twelve colleges do not offer kinesiology at all. Sixteen colleges combine anatomy and physiology in one course which continues through the entire year. The contention of those who use this method is that, as it is difficult to separate physiology from anatomy, it is the most logical way to present the work in this field. Thirty-seven of the colleges in the study do not offer the physiology of exercise at the undergraduate level, although a few of these do offer the course as graduate work. Graduate work, however, is not within the scope of this study. Only two of the colleges

do not require anatomy, although one of these does require physiology, and they both require kinesiology and physiology of exercise. It is difficult to imagine a study of kinesiology without a background of anatomy.

Department Distribution

It is interesting to note the various departments in which the different courses are taught. There are seven different categories of courses, including the combined courses: anatomy, physiology, combined anatomy and physiology, kinesiology, physiology of exercise, combined anatomy and kinesiology, and combined kinesiology and physiology of exercise.

Anatomy is taught in the physical education department in 16 of the colleges and in the zoology department in 16 others. In the remaining 28 colleges offering anatomy *alone*, it is quite uniformly distributed among other departments as follows: anatomy, biology, physiology, science, medicine, education, and veterinary anatomy.

In considering the distribution of the work in physiology among the various departments, a different picture is presented. *Physiology* is taught in the zoology department in 21 of the colleges, in the physiology department in 13, in the biology department in 12, and in the physical education department in six of the colleges. In the remaining 13 colleges offering physiology *alone*, it is about equally distributed among the other departments listed in the previous paragraph.

Combined Courses

The distribution of the *combined* courses of *anatomy and physiology* taught in the various departments is as follows: zoology department in five colleges, physical education department in four, biology department in four, the physiology department in two, and the natural science department in one college.

In the 62 colleges offering work in *kinesiology alone*, it is taught in the physical education department in all but seven of them.

The *physiology of exercise* also is taught predominantly in the physical education department—31 of the colleges teaching it in this department. It is taught in the zoology department in five colleges, in the physiology department in four, in the biology department in one, and in the education department in one college.

Of the five colleges combining *anatomy and kinesiology*, it is taught in the physical education department in four of them and in the department of veterinary anatomy in the other college.

Only four colleges combine the courses of *kinesiology and physiology of exercise* and all of these are taught in the physical education department.

Summary

In summary the following points should be mentioned:

1. Very few colleges combine courses in this field, but where it is done, the combination of anatomy and physiology is the most frequent combination.

2. The department of choice for teaching kinesiology and physiology of exercise is the physical education department.

The writer wishes to express his thanks and appreciation to those directors who cooperated in this study by taking time to offer many comments and suggestions. In order that all readers of this article may share in the benefits to be derived from those comments, a summary of them is presented here:

1. Rather than have physical education students in classes with pre-medical and predental students, it is preferable to have these courses designed for physical education major students.

2. Some prefer to have the anatomy and physiology departments teach these courses, but *only* if an understanding as to the content and method is reached with the physical education department. In regard to this point, some believe that too much *medical* anatomy is taught in physical education anatomy courses.

3. In several colleges where the anatomy is taught in other departments, the directors stated that they would prefer to have it taught in the physical education department if

they had staff members who were qualified to teach it. The thought here being that one having a background in physical education would better appreciate the special problems involved and be better able to apply anatomy to the field of physical education.

4. There is general agreement that a good background is needed in anatomy and physiology by the physical education student if he is to be successful in teaching and coaching. These courses are considered basic to an understanding of the profession.

5. Graduates of physical education who have been teaching, rate these courses very high as required courses in the physical education major program.

6. The consensus of directors of physical education is that physics should be a prerequisite for work in anatomy, and especially in kinesiology.

7. Kinesiology should not be a "re-hashing" of anatomy as such.

8. There is no thought by any director of decreasing the total requirements in these courses. On the contrary several directors expressed a desire to expand their offerings in this field.

Anyone desiring a copy of the complete report of this study may have it by writing to the author. The complete report includes data in tabular form.

American Doctoral Dissertations on Health, Physical Education, and Recreation in Foreign Countries

WALTER CROSBY EELLS
3700 Mass. Ave., N.W.
Washington, D. C.

THE WRITER HAS recently completed a study of some 15,000 doctoral dissertations in the field of education which have been accepted by American institutions of higher education. More than 1,000 of these deal with various phases of education in foreign countries.[1]

Of the dissertations concerned with foreign education, 30 deal specifically with health, physical education, or recreation in various countries. These are all products of the 20th century, the earliest having been written in 1909, at Clark University. Half of them have been written in the past ten years.

These dissertations have been accepted at 11 American universities, the largest number at Columbia University (13), followed by New York University (6), State University of Iowa (3), and eight other institutions with one each.

Following is a list of the dissertations on health, physical education, and recreation in foreign countries with name of author, title of dissertation, institution at which it was accepted, and date of acceptance. The arrangement is geographical.

NORTH AMERICA

British West Indies

STECCERIA, MORRIS. *Physical Development of Negro-White Hybrids in Jamaica, British West Indies.* University of Illinois, 1928.

Canada

DAVIDSON, STEWART A. *A History of Sports and Games in Eastern Canada Prior to World War I.* Columbia University, 1950.

FAHS, LOIS S. *The Social Situation in Seven Rural Communities in New Brunswick*

[1]Titles of all dissertations in education and related fields have been examined in *Doctoral Dissertations Accepted by American Universities* (New York: H. W. Wilson Co., 1934-54, 21 vols.); *Bibliography of Research Studies in Education* (Washington: U. S. Office of Education, 1929-41, 13 vols., and continued in manuscript to 1952); W. S. Monroe's *Theses in Education Accepted by American Colleges and Universities* (Urbana: University of Illinois, 1920-28, 6 vols.); *American Doctoral Dissertations Printed* (Washington: Library of Congress, 1912-38, 27 vols.) and many other specialized bibliographies, catalogs, and abstracts published by individual institutions and organizations. For a brief report of the study see W. C. Eells, "American Doctoral Dissertations on Foreign Education," *Higher Education* 12: 19-22, Oct. 1955.

Studied as the Basis for Planning a Program of General Recreation, with Special Emphasis on Dancing. Columbia University, 1941.

FERRIER, WILLIAM K. *Program for Alcohol Education in the United States and Canada.* Oregon State College, 1953.

PLEWES, DORIS WILLARD. *A Course of Study in Health, Physical Education, and Recreation, London, Ontario (Kindergarten—Grade XIII).* Columbia University, 1943.

VAN VLIET, MAURICE L. *A Guide to Administrative Policies for Physical Education in Canadian Public Schools, Grades One Through Nine.* University of California, 1951.

EUROPE

General

FLACK, HOWARD WATSON. *Totalitarianism and Physical Education.* (Germany and Italy). George Peabody College for Teachers, 1940.

GILL, BARBARA J. *A Comparative Review of Physical Education for Women in England and Germany, with Special Emphasis on the Period from 1933 to 1940.* State University of Iowa, 1951.

Denmark

JORGENSEN, SIGURD. *The Danish Folk High School, with Emphasis Upon the "Living Word," Folk Song, and Gymnastics.* Ohio State University, 1945.

Germany

DAMBACH, JOHN ISADOR, *Physical Education in Germany.* Columbia University, 1937.

OKTAVEC, FRANK LEOPOLD. *Professional Education of Special Men Teachers of Physical Education in Prussia.* Columbia University, 1929.

TAYLOR, JOHN WILKINSON. *Youth Welfare in Germany: A Study of Governmental Action Relative to Care of Normal German Youth.* Columbia University, 1936.

Great Britain

JONES, DORSEY D. *Edwin Chadwick and the Early Public Health Movement in England.* State University of Iowa, 1929.

Hungary

REARICK, ELIZABETH C. *Dances of the Hungarians: A Study of the Dances Found Today in Hungary, Together with a Description of Some of the Peasant Festivities.* Columbia University, 1939.

Sweden

FAWCELL, KATHLEEN. *A Study of Publicly Supported Summer Educational Services for Children in Sweden.* New York University, 1954.

ASIA

China

CHANG, HWEI-LAN. *A Colligation of Facts and Principles Basic to Sound Curriculum Construction for Physical Education in China.* State University of Iowa, 1944.

WEE, KOK ANN. *Physical Education in Protestant Christian Colleges and Universities in China.* Columbia University, 1937.

India

ANDREWS, GEORGE FRANKLIN. *Physical Education for Boys in the Secondary Schools in India: A Critical Study with Suggestions for Reconstruction.* Columbia University, 1936.

EDWARDS, SETH J. *An Educational Program of Physical Education for Schools and Colleges of the United Provinces, Agra and Oudh, India.* New York University, 1931.

HOWARD, ARTHUR WESLEY. *A Program of Physical Education for India.* University of Michigan, 1952.

NELSON, FLORA BINA. *Philosophical Approach to the Development of Physical Education Programs for Women in India.* New York University, 1951.

VARKI, KODIYAT V. *The Reorganization of Physical Education in the Secondary Schools of India.* Columbia University, 1951.

Iran

BANAI, HOSSEIN. *The Formulation and Validation of Operational Principles for a National Program of Physical Education in Iran.* New York University, 1953.

Iraq

AKRAWI, MATTA. *Curriculum Construction in the Primary Schools of Iraq in the Light of a Study of the Political, Economic, Social, Hygienic, and Educational Conditions and Problems of the Country, with Some Reference to the Education of Teachers: A Preliminary Investigation.* Columbia University, 1943.

Israel

BAVLY, SARAH. *Family Food Consumption in Palestine: Comparison of Consumption by Jewish Urban Population in 1943 and 1946 and Methods Conducive to Improvement of Food Selection.* Columbia University, 1947.

BERLIN, LEWIS LEON. *The Health Teachings and Practices Derived from the Hebrew Bible.* New York University, 1952.

Pakistan

RASHID, RIFAT JAHAN. *The Reorganization of Physical Education in Institutions of Higher Learning in Pakistan.* Columbia University, 1953.

Philippines

BOBBIT, JOHN FRANKLIN. *The Growth of Philippine Children.* Clark University, 1909.

GOSS, GEORGE E. *The Development of Organized Physical Education in the Philippine Islands.* New York University, 1932.

AFRICA

Egypt

KANDIL, IBRAHIM H. *The Construction of a Physical Education Course of Study for Egyptian Secondary Schools.* Indiana University, 1954.

Grading Practices in the Women's College Service Program

MARGARET G. FOX, Chairman
NAPECW Committee on Research and Studies

AS AN OUTGROWTH of the Washington Conference on the college service program the Committee on Research and Studies[1] of the National Association for Physical Education of College Women surveyed grading practices of departments represented in the organization. The results of the questionnaire are summarized in Table 1.

Variation in the practice of giving a grade for physical education courses was not great from one part of the country to another. There were regional differences, however, in whether these grades were used in computing overall college averages. The Eastern District showed the greatest deviation from national practice in this regard.

One criterion suggested by the Washington Conference was that evaluation techniques should be cooperatively planned within the department. However, only 45 per cent of the colleges used a departmental grading scheme, with Eastern District colleges more apt to use such a system.

Coeducational colleges and hence coeducational classes are far less common in the Eastern District than elsewhere, although questions in regard to coeducational practices were answered by only part of the colleges in all areas. Where an answer was given, men and women were more apt to be graded on the same standard than on a different one. There was apt to be no difference between grading a coeducational class and a women's class.

The alphabetical grading scheme is the most common. However, in the Eastern District a number of colleges give pass or fail grades.

[1]Committee on Research and Studies: A. Elizabeth Weber, Eastern District; Jannette Gund, Midwest District; Ellen D. Kelly, Southern District; Frances Cake, Western Society, and Margaret G. Fox, Central and Chairman.

Grading Practices in Colleges Represented by NAPECW Membership

N	Central District 49	Eastern District 33	Midwest District 56	Southern District 46	Western Society 73	National 257
	%	%	%	%	%	%
Grades Given	96	79	89	91	90	90
Used to Compute College Averages	67	30	48	70	73	60
Department Grading System Used	43	61	45	37	45	45
Coeducational Practices: No Difference in Grading Coed or Women's Classes	49	15	52	48	59	48
Men and Women in Coed Classes Graded on Same Standard	20	12	16	17	19	18
Grading System						
Alphabetical	84	58	86	78	86	81
Numerical	6	12	4	4	0	4
Pass or Fail	8	18	8	9	7	9
Least Important Items in Determining Grades						
Correct Costume	43	45	44	46	32	42
Daily Work	29	21	22	29	32	27
Items Tested to Determine Final Grade						
Knowledge of Rules	100	94	100	100	100	98
Knowledge of Techniques	96	86	85	91	85	90
Skill at End of Course	91	80	77	87	73	83
Improvement	35	36	38	30	42	36

Items suggested on the questionnaire for comprising part of the grade included attendance, attitude and effort, correct costume, daily work, improvement, knowledge of rules, knowledge of techniques and skill at the end of the course. All of these were considered by the majority. Of these factors, correct costume and daily work were considered the least important in making up the grade. Suggested additions to the above list were self ratings, sportsmanship, contribution to the group, and social skills and behavior.

Items which might comprise the grade, which were actually tested, were knowledge of rules most frequently, with knowledge of techniques relatively common also. Skill at the end of the course was not as apt to be tested as knowledge, particularly in Western Society colleges. Although the Washington Conference advocated testing at the beginning, during and at the end of a course only a little over a third of the schools reported including improvement as part of the final grade.

Summary

Failure to use physical education grades in computing overall grade point averages is one of the weaknesses in college grading systems as shown by this questionnaire. Another is the failure to use a department grading system.

It is satisfying to know that non-essentials such as wearing the correct costume do not play too great a part in grading procedures. However, more colleges could use some way of measuring skill at the end of the course. One of the neglected areas revealed by the questionnaire is the failure to measure improvement as part of the grading practices.

Research Abstracts

Prepared by the Research Abstracts Committee of the National Council of the Research Section, PAUL A. HUNSICKER, Chairman

Anatomy and Physiology

1. Bell, Alfred L. L., and Thomas W. Howell. Screening tests for pulmonary insufficiency. *Jour. of Aviation Medicine*, **26**: 218-224 (June 1955).

The need for a simple physiologic test for pulmonary insufficiency in flying personnel is discussed. The total vital capacity, the predicted vital capacity, the two- and three-second vital capacity, and the maximum breathing capacity were determined on 100 normal young males, and 30 male patients with ventilatory insufficiency. Normal values for the timed and total vital capacity tests in normal young males are established. Utilizing these simple tests, a scheme is presented which is superior to the maximum breathing capacity test to correctly discriminate patients with pulmonary insufficiency from normal young males.

By virtue of its simplicity, reliability, and sensitivity the timed and total vital capacity analysis should prove of genuine usefulness as a screening test.—*Paul Hunsicker.*

2. Buskirk, Elsworth, Henry L. Taylor, and Ernest Simonson. Relationships between obesity and the pulse rate at rest and during work in young and older men. *International Zeitschrift für Angewandte Physiologie.* **16**: 2: 83-89 (Aug. 1955).

The author found a significant correlation between resting pulse rate and relative obesity in two sedentary groups (45 young men and 82 middle-aged men), but not in an active group of young men. During walking on a treadmill, 3 miles per hour and 5% grade, all three groups had highly significant correlations between both their absolute and excess pulse rates (over resting) with fat content. During recovery, the correlations were lower. The correlation between fat content and excess work or recovery pulse rate was lowest in the middle-aged sedentary group. It was suggsted by the author that myocardial degeneration may be an important factor in the results obtained for the middle-aged group.—*Frank Sills.*

3. Counsilman, James E., Fatigue and staleness, *Athletic Journal*, **15**: 16, 26, 28-32, 44 (June 1955).

An inverse relationship has been found between fatigue and efficiency. The coach has the problem of analyzing the type of fatigue, eliminating the cause if possible, and determining what aids to recovery will be used. Oxygen has proved to be of little value in fatigue recovery, owing to the fact that oxygen cannot be stored in the body; therefore, any advantage gained from oxygen inhalation would be temporary. The use of sugar or honey has been proven to be beneficial only in cases of extreme exhaustion such as occurs in marathon running, distance swimming, etc. The best way to recover from fatigue is to rest, thereby permitting the blood coming to the area to bring in more oxygen and sugar and for the outgoing blood to carry away carbon dioxide, lactic acid, and other metabolites.—*J. Grove Wolf.*

4. Garn, Stanley M., Relative fat patterning: an individual characteristic. *Human Biology*, **27**: 2: 75-89 (May 1955).

Individual differences in relative fat patterning were investigated after converting absolute measurements into their corresponding z transforms. The measure σz indicated the extent of relative fat variability. In 81 adult males, the σz was not affected by age and only slightly by the amount of fat. Individual relative fat patterns in the z score plots of 40 men with above-medium σz values showed a number of characteristic patterns.

By comparing the z score profile patterns of 13 young men during food restriction indicated that relative fat patterns are permanent and resistent to changes in nutritional status.—*D. B. Van Dalen.*

5. GARN, S. M., and RUTH V. HARFER. Fat accumulation and weight gain in the adult male. *Human Biology*, **27**: 1: 39-49 (Feb. 1955).

Teleoroentgenograms were secured on 85 males ranging from 20-69 years of age. Eight of the 9 subcutaneous fat containing layers measured showed age-associated increases with an average increase over 4 decades of 30%. The maximum gain was exhibited by iliac fat, being 58 percent. Iliac, trochanteric, and deltoid-insertion fat were initially thicker and increased more than fat on lower arm or leg. Fat and weight increases were more marked during the 3d and 4th decades. As shown on fat-thickness, fat-weight curves, changes in surface contours resemble simple fattening. Attention was also drawn to the fact that increases in fat containing tissue also involve significant additions to non-fatty components and changes in the chemical composition of the fat.—*D. B. Van Dalen.*

6. MILLER, A. T., and CARL S. BLYTH. Influence of body type and body fat content on the metabolic cost of work. *Jour. of Applied Physiol.*, **8**: 139-141 (Sept. 1955).

The metabolic cost of work involving lifting the body was measured in 30 male college students during grade-running on a treadmill. The metabolic cost of work is predicted more accurately by gross body weight than by lean body mass, surface area, height, chest circumference or abdominal circumference. The prediction value of factors other than body weight is due largely to their respective correlations with body weight. Obesity limits the capacity for strenuous exertion by increasing the energy cost of exercise without a proportional increase in maximal capacity for oxygen uptake.—*Paul Hunsicker.*

7. MILLMAN, MAX, The great cholesterol problem, *Today's Health*, **33**: 24-25, 52-53 (Aug. 1955).

Atherosclerosis, hardening of the arteries, kills more Americans than any other affliction. A fatty substance, cholesterol, deposits itself between the middle and inner layers of the soft, elastic artery wall, causing restriction of blood flow. Later on, calcium or lime salt may also accumulate in that area. It was first found that cholesterol was present in high concentration in arteries afflicted with atherosclerosis and was later demonstrated that atherosclerosis could be produced experimentally in the laboratory animal by feeding it cholesterol. The disease is most common among people who subsist on a high-fat diet. Overweight and high-fat diet go hand in hand. Further research is in progress; however, it has been demonstrated that a diet low in fat will diminish the cholesterol content of the blood.—*J. Grove Wolf.*

8. NEWMAN, RUSSELL W., Skin-fold changes with increasing obesity in young American males. *Human Biology*, **27**: 2: 53-63 (May 1955).

Skin-fold measurements were obtained on 2,000 men before basic military training. Correlations between skin-fold sites (chest, arm, back, knee) of Negro and white men showed small and not statistically significant difference between these racial groups. Body fat on Negroes can be calculated from prediction equation based upon white subjects. A graphic comparison of the varous skin-fold sites for all men presumed increments of increasing obesity indicated a change in the proportional representation of the average site values between the lean and fat subjects. The anterior torso areas (chest and abdomen) show a rise in relative importance with increasing obesity at the expense of the extremity areas (arm and knee).—*D. B. Van Dalen.*

9. SALTER, NANCY, Methods of measurement of muscle and joint function. *Jour. of Bone and Joint Surgery* (British Volume) **37-B**: 3: 474-491 (Aug. 1955).

Subjective methods, in general, are of little or no use for studying the strength of normal muscles under different conditions, according to the author. Four objective methods of measuring strength are discussed: spring-balance, pressure systems, ergographic techniques and strain-gauge methods. The author recommends a dynamometer of the strain-gauge type. In reviewing methods of measuring the amplitude of movements in man,

the author concludes that the protractor type anthrometer is most suitable for routine clinical work, that a radiographic method is most suitable for research purposes. The following factors must be considered in taking measurements: posture, test procedure, standards for comparison, nomenclature, and normal variability.—*Frank Sills.*

Health Education

10. Carter, Howard A., What to do when hearing fades," *Today's Health*, **33**: 22-23, 63 (Oct. 1955).

A physician examining a patient with loss of hearing will: (1) examine the patient to find the extent and cause of hearing loss, (2) decide whether medicinal or other treatment is needed, (3) establish whether surgery is necessary, (4) check amplification by a hearing aid, and (5) determine whether studying lipreading will help. The hearing loss may be due to impacted wax, an infection, diseases, drugs, or a cold. Physician may wish to refer the patient to a hearing rehabilitation clinic, a list of which can be obtained from Audiology Foundation, Box 21, Glenview, Ill. Additional information may be obtained from American Hearing Society, 217 14th St., N. W., Washington, D. C.—*J. Grove Wolf.*

11. Corcoran, A. C., and Irvine H. Page, Today's treatment of high blood pressure, *Today's Health*, **33**: 18-19, 48-51 (Oct. 1955).

Hypertension may cause damage to the blood vessels, heart, brain, and kidneys. Ultimately, levels of blood pressure are regulated by sensitive nervous controls. High blood pressure may be due to kidney disease, a tumor of the adrenal gland, or it may be considered as essential hypertension (high blood pressure which comes first and has no obvious causes). The major approaches to treatment are the three D's: *Diet, Drugs,* and *Dissection.* The poison in most people's diet is salt. The diet must be limited to 500 milligrams (one-tenth of a teaspoonful) of salt per day. Veratrum, Hexamethonium, and Hydralazine (Apresoline) have been the primary drugs used in the treatment of high blood pressure. Drugs have not proven successful in all cases. Surgical dissection—the removal of the nerves that control blood flow in the abdomen, and legs (called sympathectomy)—has proven effective in about 30% of the cases.—*J. Grove Wolf.*

12. Davenport, Fred M., Comparative incidence of influenza A prime in 1953 in completely vaccinated and unvaccinated military groups. *Amer. Jour. Pub. Health*, **45**: 1138-1156 (Sept. 1955).

In 1945, a series of influenza vaccine and pseudovaccinated controls were established and certain groups of military personnel were checked. Then again in 1953, still another similar study was launched. Influenza A prime was expected. The idea behind the study was to see if differences such as housing, noninfluenzal diseases, etc., would affect the evaluation of the vaccine. A high degree of protection against influenza A prime was observed in the second field trial.—*Joseph E. Lantagne.*

13. Hundley, James N., et al. Height and weight of first-grade children as a potential index of nutritional status. *Amer. Jour. Pub. Health*, **45**: 1454-61 (Nov. 1955).

The heights and weights of first-grade children in the Philadelphia public schools were secured from the medical records for the periods 1925-27, 1932-34, and 1947-49. The data indicated that children from economically favored areas were taller and heavier than children from economically underprivileged areas. Both economic groups of children showed a secular increase in growth. During the depression years, 1932-34, children from the lower economic areas showed no interruption in their secular trend. On the other hand, children in the economically favored areas during the depression did show a significant deviation from their secular trends. This deviation was statistically significant for height in boys and for stockiness in both boys and girls. Although the data are not conclusive, they do indicate that further tests should be made of the reliability of height-

weight measurements of school children as a continuing index of nutritional status. The difficulties that arise in such a problem are discussed.—*Paul Hunsicker.*

14. McCauley, H. Berton, D.D.S., Lillian B. Davis, and Todd Frazier, Effect on oral cleanliness produced by dental health instruction and brushing the teeth in the classroom. *Jour. School Health,* **25**: 9: 250-254 (Nov. 1955).

Early in the year 1953-54, the Division of Health and Physical Education of the Department of Education and the Bureau of Dental Care of the Baltimore City Health Department embarked on a study in health education. This study is known as the Baltimore Tooth-Brushing Study. The study involved nearly 800 children, mostly fifth graders. Gains in oral cleanliness realized through instruction and repeated inspections diminished gradually after instruction was discontinued. After a four-week instruction period, there was an improved general state of dental health for about five months.—*Joseph E. Lantagne.*

15. Mosher, William E., and Adfur E. Maines, A screening program for the detection of hearing loss in preschool children. *Amer. Jour. Pub. Health,* **45**: 9: 1101-1108 (Sept. 1955).

Early detection of hearing loss is of extreme importance to the child age two to six. There is no need of a child to arrive at school with an unknown hearing impairment. Seldom is the mass technique used at this age. During 1951-54, a total of 5,152 children were tested successfully by audiometer technicians in the Buffalo Schools. Children with severe hearing losses were referred to private physicians. Sixty-three children were found to have severe hearing loss. Educational and medical recommendations were made. The hearing clinics were inexpensive and effective for preschool children.—*Joseph E. Lantagne.*

16. Stiles, William W., M.D., and Lois Watson, R.N., Public health interests of college students. *Jour. School Health,* **25**: 8: 224-228 (Oct. 1955).

Effective public health education depends upon the correct interpretation of both the needs and interests of the learner. The thinking of 2,112 students over a period of four years at the University of California was analyzed. Recognition and treatment of those areas which had the greatest appeal made the course more effective.—*Joseph E. Lantagne.*

Psychology

17. American Psychological Association, Inc., Technical recommendations for psychological tests and diagnostic techniques. Supplement to the *Psychological Bulletin,* **51**: 2: Part 2 (March 1954).

A guide representing a consensus of what the test producer could provide that would be most helpful to the test consumer seemed desirable. Such a report also would serve the test user as a guide in considering certain features when selecting a test for particular programs. A joint committee of the American Psychological Association, American Educational Research Association, and the National Council on Measurements Used in Education compiled such a guide. In so doing, this committee called attention to recent developments in thinking about tests and test analysis.

Recommendations in this guide apply to published devices used for diagnosis and evaluation; tests of aptitude or ability, achievement tests, inventories (interest and personality), and projective instruments and related clinical techniques. Each recommendation has been classified as *essential, very desirable,* and *desirable.* In test development and reporting, attention has been called to: (a) dissemination of information, (b) interpretation, (c) validity—content, predictive, concurrent, and constructive, (d) reliability—coefficients of internal consistency, equivalence, and stability, (e) administration and scoring and (f) scales and norms.—*Frances Z. Cumbee.*

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